Geol Survey

DALLAS CITY AREA

Hancock and Henderson Counties

Geological Science Field Trip

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Department of Energy and Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
Champaign, IL 61820

A GUIDE TO THE GEOLOGY OF THE DALLAS CITY AREA

By

D. L. Reinertsen and J. M. Masters

16 May 1987

GEOLOGICAL SCIENCE FIELD TRIPS are free tours conducted by the Educational Extension Section of the Illinois State Geological Survey to acquaint the public with the geology and mineral resources of Illinois. Each is an all-day excursion through one or several counties in Illinois; frequent stops are made for explorations, explanations, and collection of rocks and fossils. People of all ages and interests are welcome. The trips are especially helpful to teachers in preparing earth science units. Grade school students are welcome, but each must be accompanied by a parent or guardian. High school science classes should be supervised by at least one adult for each ten students. A list of available earlier field trip guide leaflets for planning class tours and private outings may be obtained by contacting the Illinois State Geological Survey, Natural Resources Building, 615 East Peabody Drive, Champaign, IL 61820. (217) 244-2407 or 333-7372.

GEOLOGIC FRAMEWORK

Geologic Setting of the Dallas City Area.

Physiographically, the Dallas City area is situated near the western border of the Till Plains Section of the Central Lowland Province (fig. 1). Here, the rugged topography along the Mississippi River bluffs contrasts markedly with the more even, relatively undissected Illinoian till plain (Galesburg Plain) in the southern and eastern parts of the field trip area. The area can be described as being in a late youth stage of development. That is, close to the master stream, the Mississippi River, there are still remnants of flat uplands between the tributary streams draining the area; valley walls, generally, are fairly steep; and, the tributary streams are only beginning to develop flat areas along their valley bottoms. Away from the bluffs, only a few streams have extended their courses headward into the generally flat upland surface.

A network of streams drains the Dallas City area northward and westward into the Mississippi River, the area's most conspicuous topographic feature. This part of the Mississippi Valley is 5 to 7 miles wide and lies at the upstream end of the gorge, or "lower rapids," between Nauvoo and Keokuk. This broad valley, which is confined between prominent bedrock bluffs, mantled by relatively thin glacial till and windblown loess (pronounced "luss") on the south and east side, and very thick glacial deposits on the west, formerly was part of the Ancient Iowa River (this will be explained further at Stop 6).

About 3,100 feet of sedimentary rocks underlie the field trip area and consist primarily of sandstone, limestone, dolomite, and shale that were deposited layer upon layer in ancient seas that covered the mid-continent region during the Paleozoic Era, between 570 million and 245 million years ago. The Paleozoic strata are divided into major subdivisions known as Systems, each of which was deposited during a specified period of geologic time. The Systems are in turn subdivided into many formations on the basis of mineral composition and fossil content. Approximately 200 feet of Valmeyeran (middle Mississippian) age rocks are exposed in the Dallas City area (see Mississippian Deposition in appendix). These strata were deposited about 340 million years ago. No Chesterian (late Mississippian) strata are known from this area. If they once covered this area, an unknown thickness (perhaps several hundreds of feet) of these rocks has been eroded away. Scattered occurrences of younger rocks of Pennsylvanian age, some of which contain small deposits of coal, also have been reported, especially from Hancock County. These reports indicate that at one time, these younger strata were considerably more extensive geographically than now, but erosion has removed most of them. Older formations belonging, in descending order, to the Devonian, Silurian, Ordovician, and Cambrian Systems are known from deep wells that penetrate them, or from other areas in Illinois where they are exposed at the surface (see attached Geologic Map). The basal Cambrian strata, about 525 million years old, rest upon an ancient basement of Precambrian igneous and metamorphic granitic-like rocks that are more than 1 billion years old. The uneven surface of the Precambrian basement rocks is an erosion surface similar to the exposed land surface today. Sedimentary rocks ranging in age from about 1 billion to 525 million years old may once have covered this ancient surface, but the evidence of their existence, so far as we know, has been completely eroded away. All that remains is a huge gap (hiatus) between the age of the Precambrian basement rocks and the age of the oldest sedimentary rocks that now rest on this ancient erosion surface.

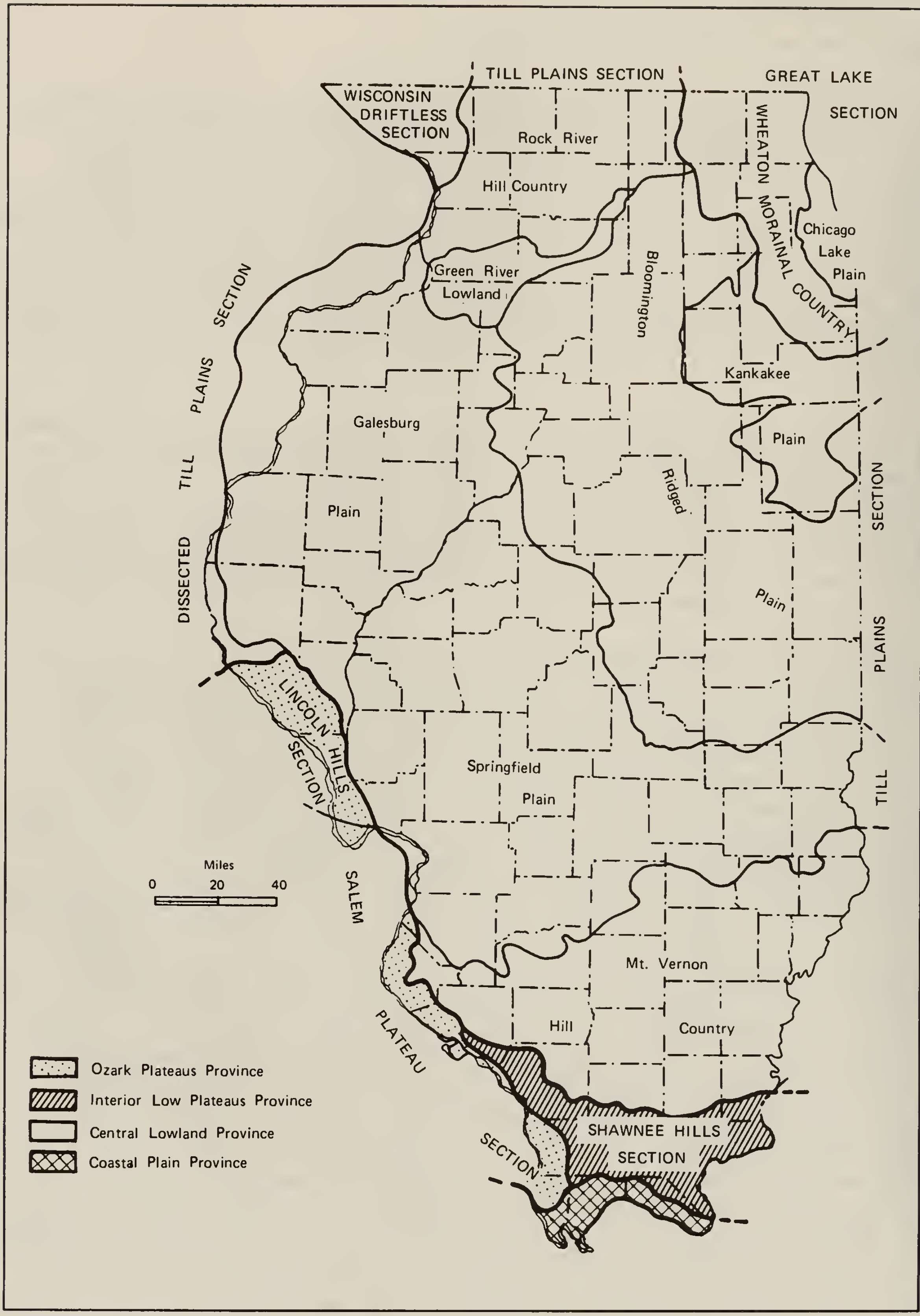


Figure 1. Physiographic divisions of Illinois

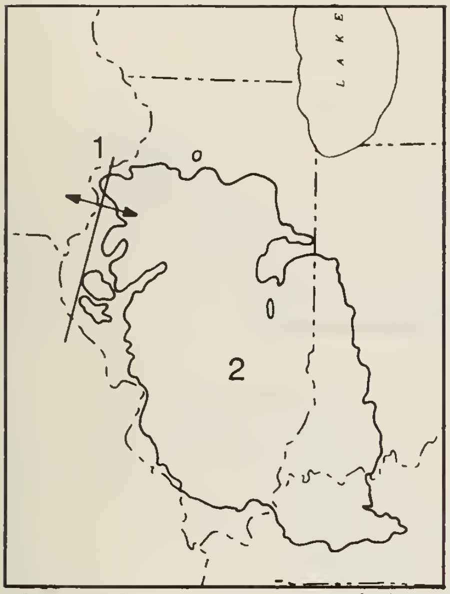


Figure 2. Index map with locations of (1) Mississippi River Arch, and (2) Illinois Basin.

Geologically, the Dallas City area is located slightly east of the crest of the broad Mississippi River Arch (fig. 2), which borders the northwestern shelf area of the Illinois Basin, a large spoon-shaped depression that underlies most of Illinois and some adjacent parts of Indiana and Kentucky (fig. 2). Smaller structural features are developed on the larger structures in areas near the field trip. Regionally, the bedrock dips gently to the southeast toward the deepest part of the Illinois Basin. While this basin was forming during the Paleozoic Era, it was filled gradually with Paleozoic sediments which eventually became lithified. These strata total more than 13,000 feet in thickness in the deepest part of the basin in extreme southeastern Illinois. Rocks of Pennsylvanian age, deposited from 320 million to nearly 285 million years ago, are the youngest Paleozoic strata found in the basin and may represent the last of the marine invasions during that era. On the other hand, marine conditions may have persisted into the Permian Period, that marks the close of the Paleozoic Era, with the sea withdrawing for the last time about 245 million years ago. If rocks of Permian age were deposited across what is now Illinois, they apparently have been removed completely by erosion because there are no known deposits of this age in the state. Therefore, it appears likely that most of Illinois has been above sea level and exposed to erosion at least since the close of the Paleozoic Era. During this extremely long period of erosion, all of any Permian strata deposited here, considerable thicknesses of Pennsylvanian strata, and many older rock strata were removed.

Mineral Production. Ninety-eight of the 102 Illinois counties reported mineral production during 1985, the last year for which totals are available. The estimated total value of all mineral production in Illinois was more than \$3.76 billion. Hancock County produced stone from 3 quarries, and crude oil. Henderson County produced sand and gravel and stone from 3 quarries (2 producers). Because of the few number of producing companies for each of the mineral commodities in both counties, the individual production figures are not given here in order to protect the confidentiality of each producer.

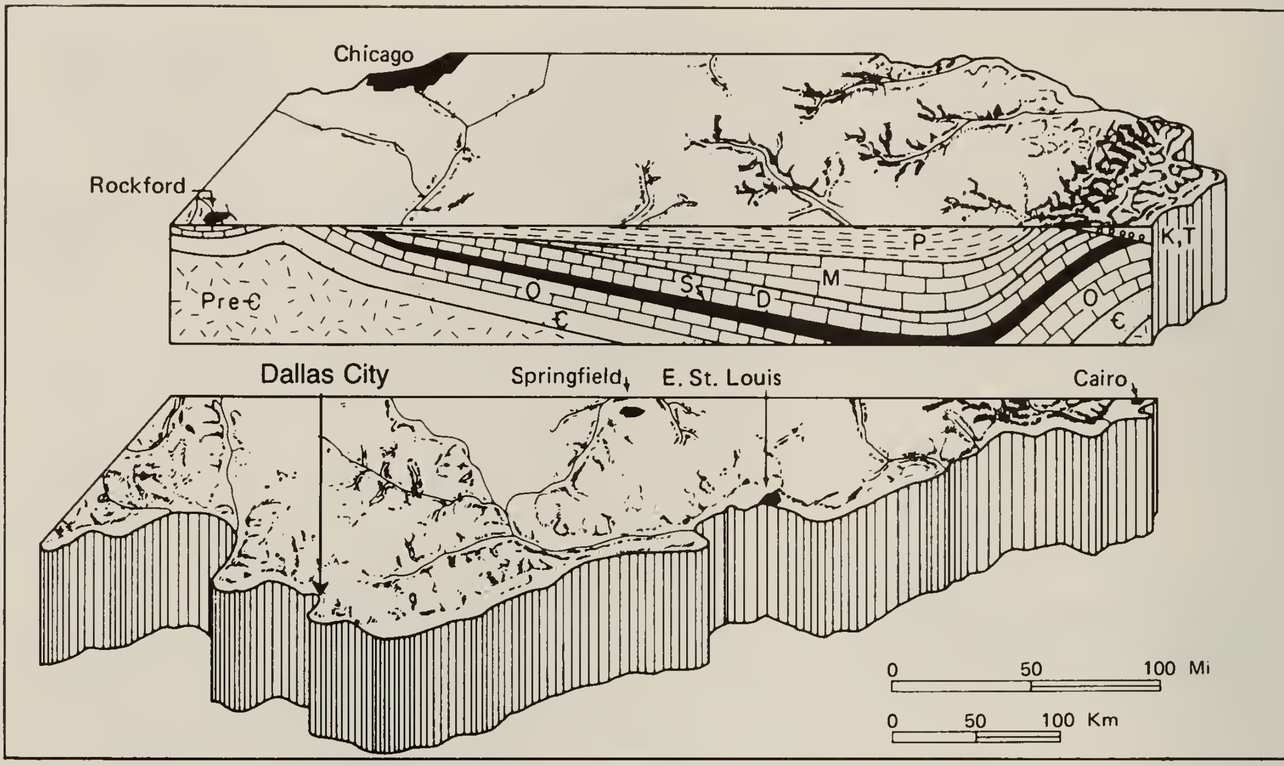
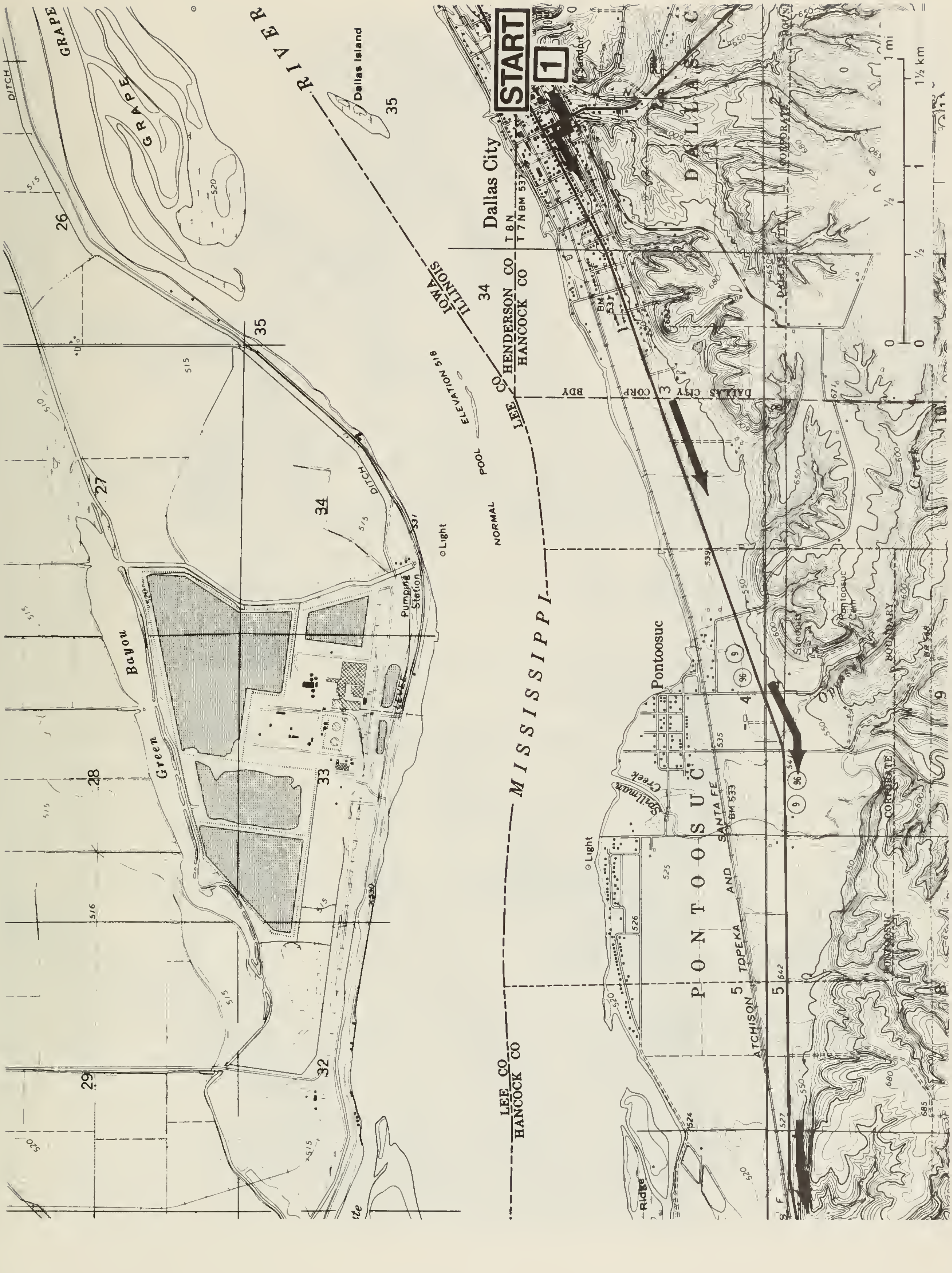


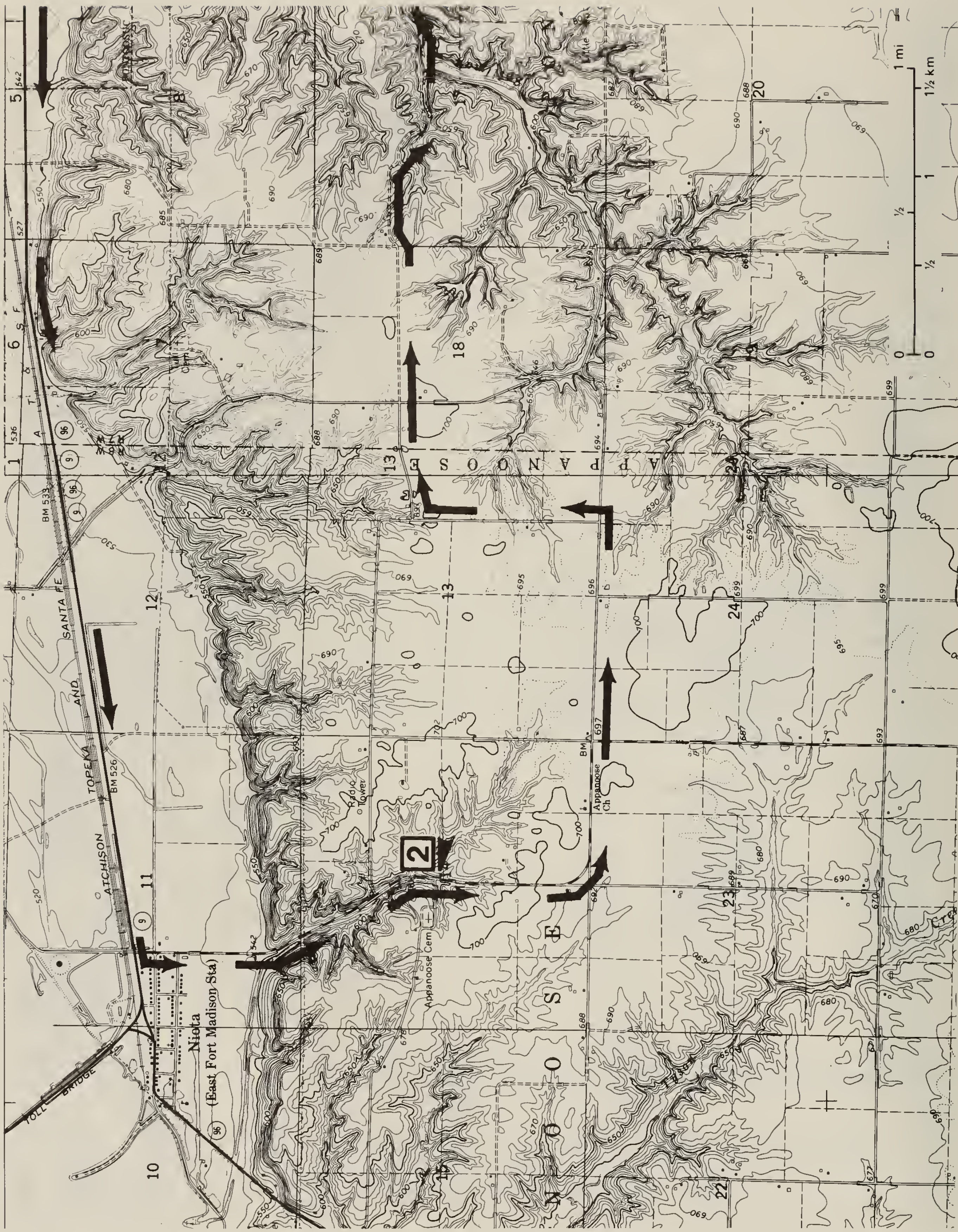
Figure 3. Stylized north-south cross section shows the structure of the Illinois Basin. In order to show detail, the thickness of the sedimentary rocks has been greatly exaggerated and the younger, unconsolidated surface deposits have been eliminated. The oldest rocks are Pre-cambrian (Pre-C) granites. They form a depression that is filled with layers of sedimentary rocks of various ages: Cambrian (C), Ordovician (O), Silurian (S), Devonian (D), Mississippian (M), Pennsylvanian (P), Cretaceous (K), and Tertiary (T). The scale is approximate.

GUIDE TO THE ROUTE

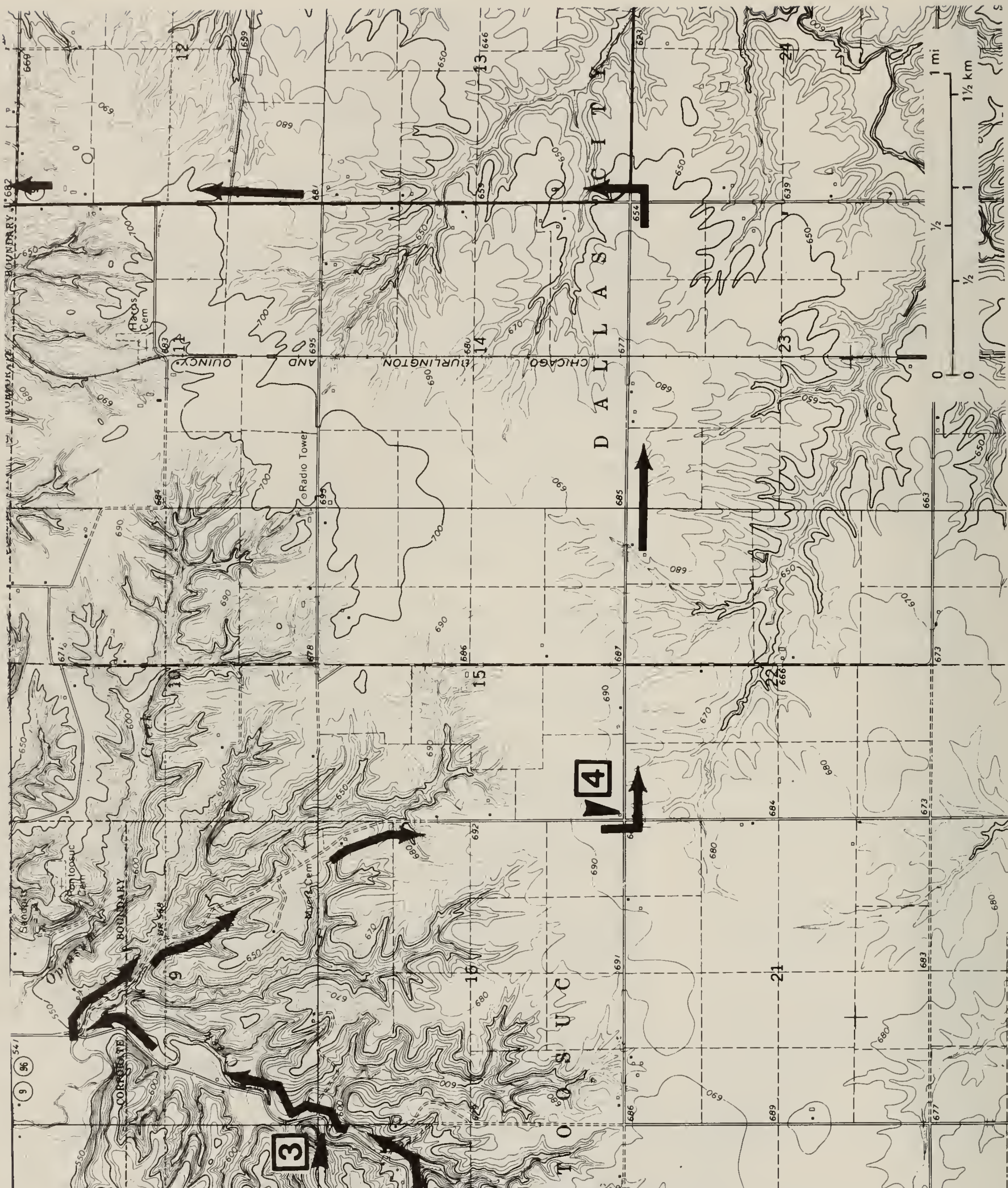
NOTE: Please drive with your lights on while the caravan is moving--turn them off when we park. **PARK CLOSE:** Drive safely and stay as close as you can to the car in front of you.

Miles to next point	Miles from start	
0.0	0.0	Mileage figures begin at the intersection of East Fourth and Elm Streets. Line up heading southwest on East Fourth Street at the stop sign.
		STOP 1. Discussion of stonework of the Dallas City High School and the nearby Mississippian Keokuk Limestone exposures.


START
1
Dallas City
T 8 N
T 7 N
BM 537
HENDERSON CO
HANCOCK CO
LEE CO
HANCOCK CO
IOWA
ILLINOIS
RIVER
MISSISSIPPI
Dallas Island
NORMAL
POOL
ELEVATION 518
Light
Pumping Station
DITCH
LEVEE
GRAPE
Green
Bayou
Pontoosuc
PONTOOSUC
ATCHISON
TOPEKA
AND
SANTA FE
BM 533
Stillman Creek
Ridge
DALLAS CITY CORP BDY
Pontoosuc Cem
CORPORATE
BOUNDARY
Creek
26
27
28
29
32
33
34
35
3
4
5
9
10
1 mi
1½ km


Niota
(East Fort Madison Sta)
ATCHISON
TOPEKA
AND
SANTA FE
TOLL BRIDGE
APPANOOSE
Appanoose Cem
Appanoose Ch
Radio Tower
1 mi
1½ km

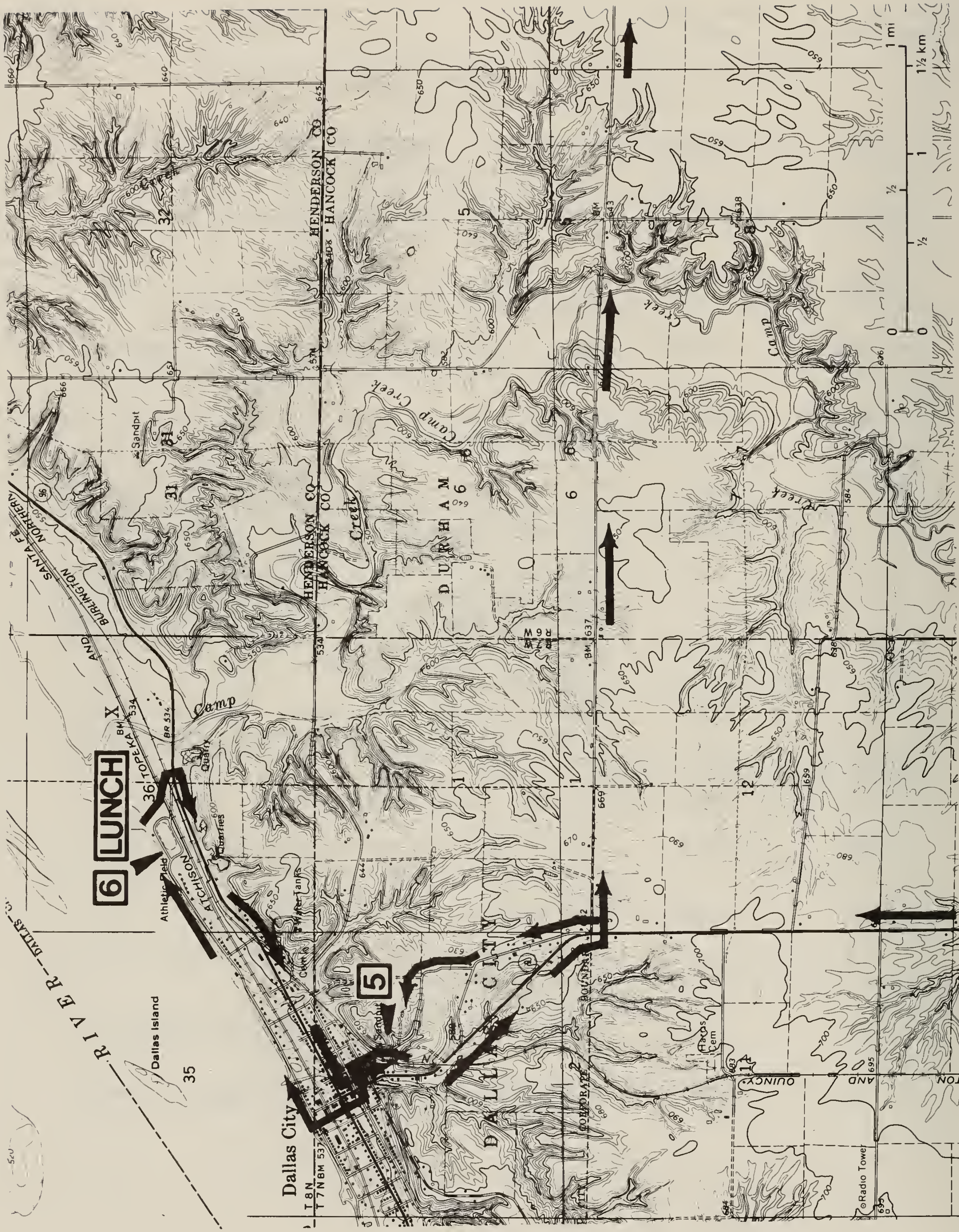
Miles to next point	Miles from start	
0.0	0.0	Leave Stop 1. STOP: 4-way. CONTINUE AHEAD (southwest) on East Fourth Street.
0.1-	0.1-	STOP: 2-way. TURN RIGHT (northwest) on Oak Street and State Route (SR) 9.
0.05-	0.1+	STOP: 4-way; junction SRs 9 and 96. TURN LEFT (southwest) on East Second Street and SRs 9 and 96.
1.05-	1.15+	Leave Dallas City limits. To the right, in the far distance is the west valley wall of the Mississippi River. West of the river, the floodplain is fairly wide.
1.1-	2.25	Pontoosuc Road to right. CONTINUE AHEAD (southwest).
3.9	6.15	Prepare to turn left on the east edge of Niota.
0.15-	6.3-	TURN LEFT (south) at crossroad (2850N; 1120E).
0.4+	6.7+	In the farmyard to the right is a large glacial erratic.
0.45-	7.15	Large slumped area to the left. Glacial till exposed here, just below the thin loess at the top of the cut, may be pre-Illinoian in age.
0.25+	7.4+	T-road (2760N; 1150E) from right (west). CONTINUE AHEAD (south) and prepare to stop.
0.05-	7.45	Park along road-shoulder as far off the macadam as you can safely.
		STOP 2. Pleistocene glacial deposits and underlying bedrock strata of Mississippian age exposed in roadcuts, ditches, and stream cuts.
0.0	7.45	Leave Stop 2 and CONTINUE AHEAD (south).
0.4+	7.85+	BEAR LEFT (east) on the macadam at the Y-intersection.
0.3	8.15+	Appanoose Church to left.
0.25-	8.4+	CAUTION: crossroad (2700N; 1200E). CONTINUE AHEAD (east).
0.65-	9.05	Prepare to turn left.


D A L L A S C I T Y
P O N T O O S U C
CORPORATE
BOUNDARY
CHICAGO
BURLINGTON
AND
QUINCY
Radio Tower
3
4
0 ½ 1 mi
0 ½ 1½ km

Miles to next point	Miles from start	
0.1+	9.15+	TURN LEFT (north) at T-road (2700N; 1280E) on to crushed rock road.
0.65	9.8+	TURN RIGHT (east) at T-road intersection (2760N; 1280E). A cattle feed lot is located on the northeast corner of this intersection. The slopes are completely denuded of any cover, so there is little to keep heavy rainfall from eroding the slopes. This results in abnormal siltation farther downstream.
0.4	10.2+	CAUTION: unguarded crossroad (2760N; 1320E). CONTINUE AHEAD (east) on to the crushed stone roadway.
1.2-	11.4	CAUTION: weed-covered concrete culvert just before the intersection.
0.05-	11.45-	CAUTION: unguarded T-road intersection on a curve. BEAR LEFT (northeasterly).
0.05+	11.5+	Rather thin-bedded silty dolomite exposed in roadcut to left. To the right you will see that Spillman Creek is largely sandy bottomed with a little gravel occasionally.
0.3	11.8+	T-road intersection (2780N; 1500E) from right. CONTINUE AHEAD (northerly).
0.2+	12.05	Park along side of road. CAUTION--do NOT block roadway; shoulder is narrow in places.
		STOP 3. Mississippian Sonora Formation exposed in abandoned Lantry Quarry, also known as the "Snake Den."
		NOTE: across the road on the inside of the road curve and along a meander curve of Spillman Creek is a large stand of <u>Equisetum</u>, a scouring rush. This plant type is the only modern survivor of many similar forms that grew to tree-size during the Pennsylvanian Period, 320 million to nearly 285 million years ago.
0.0	12.05	Leave Stop 3. CONTINUE AHEAD (northerly) on the rock surfaced road.
0.8	12.85	To the right across Spillman Creek, there is a large slump area.

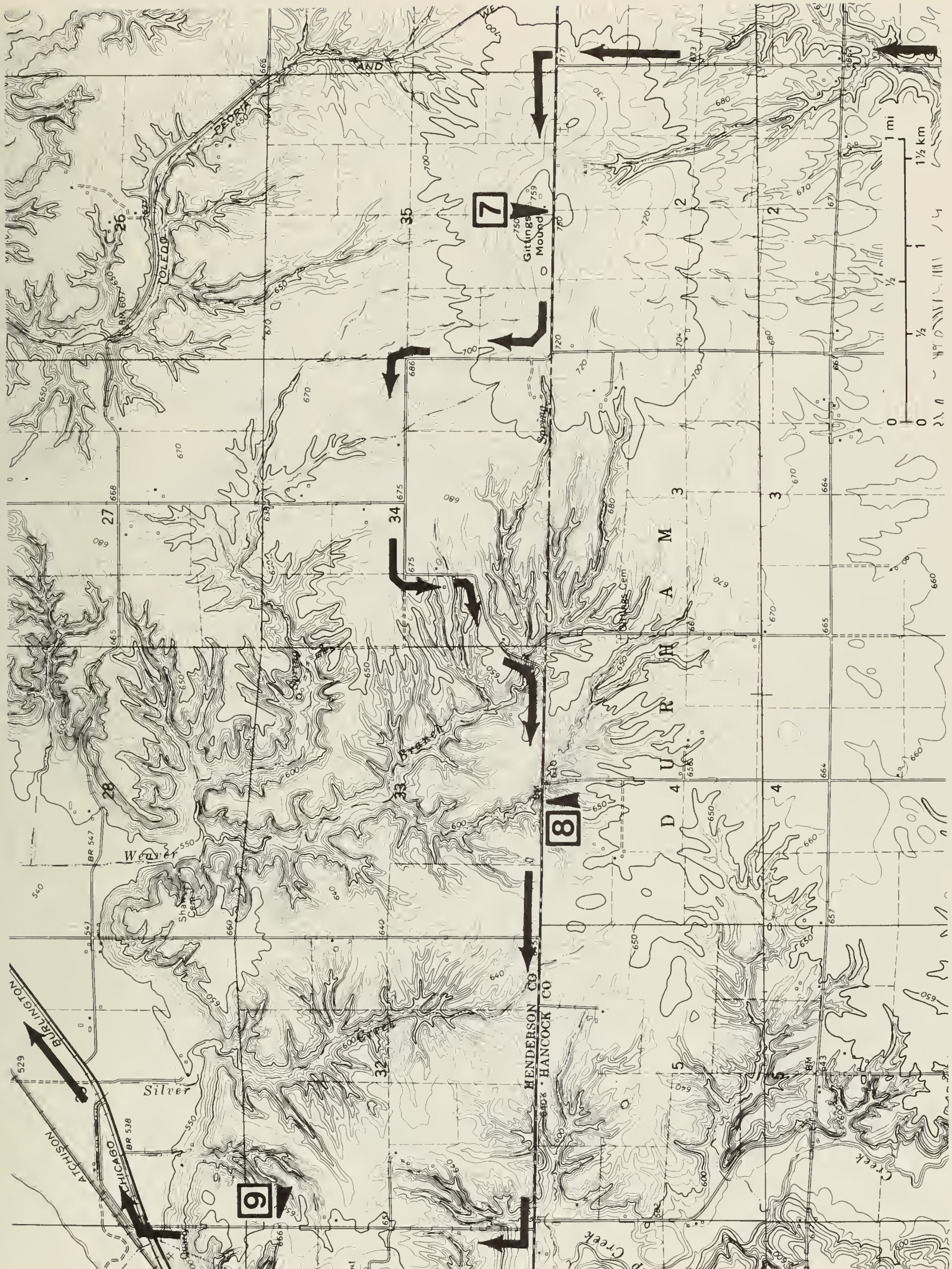
Miles to next point	Miles from start	
0.05	12.9	Note new home to the right that is built on the floodplain of Spillman Creek.
0.1+	13.0+	CAUTION: concrete ford across Spillman Creek. NOTE: you will make a sharp right turn at the top of creek bank, so you most likely will need to swing to the left first! Visibility is restricted!
0.45-	13.45	CAUTION: a slight jog in the road takes you across a tributary to Spillman Creek. A concrete side to the culvert sticks up on the right side. There is NOTHING on the left side but open space!
1.6+	15.05+	CAUTION: crossroad (2700N; 1600E). TURN LEFT (east) and prepare to stop.
0.05-	15.1-	Park along shoulder and far enough away from the intersection so as not to be a hazard to traffic. CAUTION: FAST TRAFFIC.
		STOP 4. Glacial erratic in northwest corner of farmyard.
0.0	15.1-	Leave Stop 4. CONTINUE AHEAD (east) on macadam.
2.0+	17.1+	STOP: 2-way at crossroad (2700N; 1800E). TURN LEFT (north).
0.05	17.15+	STOP: 1-way at intersection with SR 9 on the far side of a curve. CAUTION: RESTRICTED VISIBILITY AND FAST TRAFFIC. CONTINUE AHEAD STRAIGHT (north).
1.9	19.05+	Prepare to continue ahead off of SR 9 at curve.
0.1+	19.15+	CAUTION: Dallas City boundary.
0.05-	19.2-	CAUTION: LEAVE SR 9 at its curve to left and CONTINUE AHEAD (northerly) on oiled road in front of the elementary school.
0.35+	19.55+	CURVE LEFT (northwesterly).
0.05-	19.6-	TURN RIGHT (north) on narrow lane at T-road intersection.
0.45+	20.05+	Park along edge of narrow road without blocking the road or driveways.

Miles to next point	Miles from start	
		STOP 5. Abandoned construction materials pit in loess bluff.
0.0	20.05+	Leave Stop 5. CONTINUE AHEAD (northwesterly) down the hill on Elm Street.
0.1+	20.2-	STOP: 1-way. TURN LEFT (southwest) on East Fifth Street.
0.05+	20.25+	STOP: 2-way. TURN RIGHT (northwest) on Oak Street and SR 9.
0.1+	20.35+	STOP: 4-way. SR 9 and 96 junction. CONTINUE AHEAD STRAIGHT (northwest) on Oak Street.
0.05+	20.4+	CAUTION: guarded Santa Fe (SF) and Conrail (CR) 2-track crossing.
0.05	20.45+	Enter Henderson County. CAUTION: just beyond is an unguarded cross street. NOTE: straight ahead is a small park and former boat landing. The large boulder with its plaque commemorates Abraham Lincoln's visit and speech on October 23, 1858. The 12-ton, coarse-grained granite boulder was moved from a nearby farm in 1936 by the local American Legion post. TURN RIGHT (northeast) on First Street parallel to the river.
0.1+	20.6+	CAUTION: cross 1-lane bridge. This is the same stream that has the Keokuk strata exposed in it near the high school.
0.4+	21.0+	CAUTION: cross 1-lane bridge.
0.45+	21.5+	Enter Dallas City Recreation Park. BEAR LEFT (northeast) at Y-intersection.
0.05-	21.5+	Park along drive but do not block it.
		STOP 6. LUNCH followed by discussion of Mississippi Valley history.
0.0	21.5+	Leave Stop 6. CONTINUE AHEAD (northeasterly) part way around the oval drive.
0.1+	21.6+	CURVE RIGHT (southerly) along southwest side of ball park.


6
LUNCH
5
Dallas City
Dallas Island
RIVER
HENDERSON CO
HANCOCK CO
DURHAM
Camp Creek
Athletic Field
Quarries
Quarry
Sandpit
Water Tank
Radio Tower
QUINCY
T 8 N
T 7 N
R 7 W
R 6 W
1 mi
1½ km

Miles to next point	Miles from start	
0.1-	21.7	USE EXTREME CAUTION: TURN HARD LEFT (easterly) and ascend road to SF and CR railroad 2-track guarded crossing. FAST TRAINS! CONTINUE AHEAD (easterly). Do **NOT** stop on tracks!
0.1+	21.8+	STOP: 1-way; T-road intersection with SR 96. TURN RIGHT (southwesterly).
0.65+	22.5	The Riverview Supper Club to the right is in the former main assembly building of the Burg Factory. This factory manufactured and assembled buggies, wagons, carriages, and automobiles from 1891 until 1919. (Only one of about 40 Burg Automobiles manufactured survives.)
0.1+	22.6+	The stone castle to the right, on the north corner of East Third and Chestnut Streets, is the former home of Lewis Burg, owner of the factory. The house was designed by a German architect to resemble a Rhine castle and was built in the early 1890s. The stone used on the exterior is light gray, medium-grained limestone, much of which is almost entirely a fossil "hash" of crinoid, brachiopod, bryozoan, and coral fragments. The stone appears to be the Mississippian Keokuk-Burlington Limestone that may have come from one of the quarries a short distance to the northeast.
0.25	22.85+	Enter Hancock County.
0.2-	23.05+	STOP: 4-way. TURN LEFT (southeast) on Oak Street, SR 9.
0.95	24.0+	Prepare to turn left.
0.15-	24.15	CAUTION: TURN LEFT (east) at T-road intersection (2900N; 1800E) on the south side of the elementary school.
2.2+	26.35+	Cross Camp Creek.
1.0-	27.35	The upland here has a low, gentle relief.
0.6	27.95	The low hill with pine trees on top at about 10:30 o'clock is Gittings Mound, the site of Stop 7.

Miles to next point	Miles from start	
1.75+	29.7+	The crest of Gittings Mound is 1.1 miles due north and approximately 90 feet higher than this point on the route.
0.4	30.1+	Prepare to turn left.
0.1-	30.2+	TURN LEFT (north) at crossroad (2900N; 2400E) onto rock road.
1.0	31.2+	CAUTION: unguarded T-road intersection (3000N; 2400E - Hancock County) (00N; 800E - Henderson County). TURN LEFT (west) and ascend Gittings Mound.
0.5+	31.75+	Park along roadside. Please, do NOT block driveways.
		STOP 7. View of Illinoian till plain from near top of Gittings Mound.
0.0	31.75+	Leave Stop 7. CONTINUE AHEAD (west).
0.45+	32.2+	CAUTION: unguarded, off-set T-road intersection (Hancock County: 3000N; 2300E) (Henderson County: 00N; 700E). TURN RIGHT (north).
1.0+	33.25+	STOP: 1-way; T-road intersection (70N; 630E). CONTINUE AHEAD (west).
0.85	34.1	CAUTION: T-road from left. CONTINUE AHEAD (south-southwest) and cross Weaver Branch.
0.45+	34.55+	CAUTION: T-road from left (00N; 550E). CONTINUE AHEAD (west) and prepare to stop.
0.1-	34.65+	Park along roadside.
		STOP 8. Roadcut exposure of Wisconsinan Peoria Loess and example of noncompliance roadside dumping.
0.0	34.65+	Leave Stop 8 and CONTINUE AHEAD (west).
0.45	35.1+	T-road from right (00N; 500E). CONTINUE AHEAD (west).
0.9+	36.05	Prepare to turn right ahead.
0.05+	36.1+	T-road from left (3000N; 2000E - Hancock County). CONTINUE AHEAD (west).

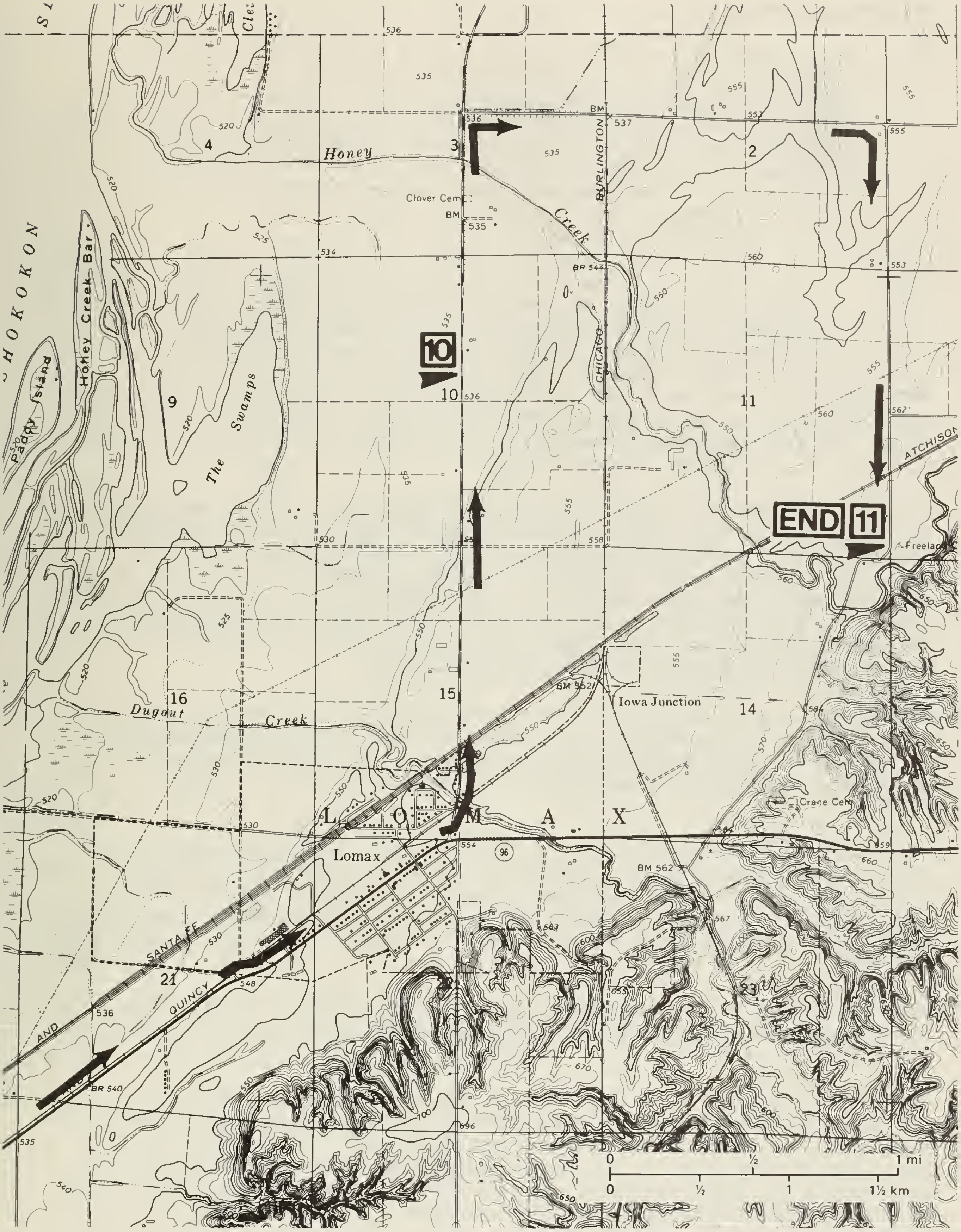

7
8
9
Gittings Mound
HENDERSON CO
HANCOCK CO
D U R H A M
PEORIA
TOLEDO
AND
CHICAGO
BURLINGTON
ATCHISON
Weaver
Silver
Creek
Branch
Spring
Shaw Cem
0
½
1
2
1 mi
1½ km
26
27
28
32
33
34
35
2
3
4
5

Miles to next point	Miles from start	
0.05-	36.15+	TURN RIGHT (north) at T-road (00N; 400E) intersection. NOTE: to the right just after the turn there is a large slumped area part way up the hill.
0.6	36.75+	The hills to the left are sand dunes near the bluff line.
0.15+	36.9+	CAUTION: the road has some washouts on both sides across this little sag.
0.15	37.05+	Park along roadside.
		STOP 9. Roadcut exposure of Wisconsinan Parkland Sand.
0.0	37.05+	Leave Stop 9 and CONTINUE AHEAD (north).
0.25	37.3	Prepare to descend a rather steep grade through this narrow roadcut in the Peoria Loess. Part way down the grade, the road levels out on a small bench underlain by limestone.
0.1-	37.4-	You are just above the bench in the road. There is a spring line here indicating the probable presence of some glacial till between the loess and the underlying limestone. Groundwater has percolated downward through the loess until it encountered the relatively impermeable till. It flowed slowly toward the bluff to produce a line of seeps or small springs in some places.
0.05-	37.4+	You are on a fairly well-developed bench in the road here that is held up by the underlying Mississippian Keokuk-Burlington Limestone. Pieces of the rock are along the roadside. An abandoned, overgrown quarry in these strata is just west of this road a few tens of feet.
0.05-	37.45	The road steepens across the frontal edge of the underlying limestone. This is an example of one of the clues or "tools" that a geologist looks for or uses in deciphering the geology of an area.
0.05+	37.5+	STOP: 2-way; crossroad (130N; 450E). CAUTION: FAST TRAFFIC. TURN RIGHT (northeasterly) on SR 96.

Miles to next point	Miles from start	
1.6	39.1+	The ground to the right that is slightly higher than the road is part of a terrace.
0.55	39.65+	CAUTION: enter village of Lomax. You are now coming up onto the terrace surface.
0.75	40.4+	Prepare to turn left.
0.1	40.5+	TURN LEFT (north) on the Carman Road. This road also leads to U.S. 34 beyond Carman.
0.15	40.65+	Cross Dugout Creek.
0.15+	40.8+	CAUTION: guarded 3-track SF and CR crossing.
0.55	41.4-	Powerline crossing beyond which there is a break in slope as you come down off the terrace level.
0.75+	42.15	CAUTION: park along roadside; fast traffic.
		STOP 10. Discussion of Pleistocene terrace deposits.
0.0	42.15	Leave Stop 10 and CONTINUE AHEAD (north).
0.7+	42.85+	Cross Honey Creek and prepare to turn right.
0.15+	43.05	TURN RIGHT (east) at crossroad (575N; 630E).
0.2	43.25	To the right at about 1:30 o'clock is a good view of a Parkland Sand dune up on the edge of the terrace.
0.45	43.7+	Start to ascend terrace.
0.1-	43.8	You are on top of the terrace here.
0.35	44.15	This sag, that the road has descended into, appears to be a remnant of a channel that may have been occupied by Honey Creek at an earlier time when its bed was at a much higher level than it is now. A study of the topographic map shows indications of an alluvial fan extending out into the Mississippi Valley from Honey Creek. Its present course is most likely the result of a natural shift in its channel position when the older channel became filled with sediments.
0.35	44.5+	TURN RIGHT (south) at small Y-intersection (575N; 775E).

Miles to next point	Miles from start	
0.4-	44.9	Groundwater levels are high in the Mississippi Valley and shallow wells are used for high capacity irrigation projects. The irrigation tower is powered by water from a central well around which it pivots.
0.45+	45.35+	Powerline tower crossing
0.1+	45.5+	T-road from left; CONTINUE AHEAD (south).
0.1	45.6+	The road crosses a Parkland Sand dune.
0.1	45.7+	CAUTION: guarded 2-track SF and CR crossing. You are still on the sand dune.
0.25	45.95+	Park along roadside. You MUST HAVE permission to enter this property (from the first house on the right, south from here).
		STOP 11. Discussion of Pleistocene Lomax Section and erosion control measures; and collecting rock samples from gravel bars in Honey Creek.
		END OF FIELD TRIP

Continue ahead (south) for about 1.25 miles to SR 96. Turn right (west) for Lomax, Dallas City, etc. Turn left (east) for SR 94 to go north to US 34 or south to SR 9.


Honey Creek
Clover Cem
BURLINGTON
CHICAGO
Honey Creek Bar
Paddy Island
The Swamps
10
END 11
ATCHISON
Freeland
Dugout Creek
Iowa Junction
LOMAX
Lomax
Crane Cem
SANTA FE
AND
QUINCY
0 ½ 1 mi
0 ½ 1 1½ km

FIELD TRIP STOPS

NOTE: The numbers in parentheses following the topogrphic map name, (40091F2), is the code assigned to that map as part of the National Mapping Program. The state is divided into 1^{0} blocks of latitude and longitude. The first pair of numbers refers to the latitude of the southeast corner of the block and the next three numbers designates the longitude. The blocks are divided into 64 7.5-minute quadrangles; the letter refers to the east-west row from the bottom and the last digit refers to the north-south row from the right.

STOP 1. Discussion of construction materials in the original Dallas City High School building and the nearby Mississippian Keokuk Limestone outcrop [W½ NW¼ NE¼ and SE¼ NE¼ NW¼ Sec. 2, T. 7 N., R. 7 W., 4th P.M., Hancock County; Dallas City 7.5-minute Quadrangle (40091F2)].

The "Northwest fractional quarter of section two...," that later was to become the town of Dallas was entered in the original Land Entry Book on June 7, 1836. One that same day, the property was assigned by the owner to another man who built the first log home here.

The town, which was originally called South Bend, was laid out during October of 1848, by John Finch, who eventually purchased all of the NW fractional quarter of Sec. 2 from the earlier assignee. The east side of the NW¼ is about 150 feet due west from Mileage Point 0.0 (remember, the streets are not oriented north-south and east-west). About 1850, the town name was changed to honor U.S. Vice President George M. Dallas (1845-1849). The incorporating act was approved on February 19, 1859, and authorized the name change from the "Town" of Dallas City to the "City" of Dallas City.

Lewis Burg, a prominent local manufacturer, felt that the new high school, probably in part because of its proximity to the Mississippi River, should resemble a castle along the Rhine River of Germany. The cornerstone was laid on October 31, 1895, and the 3-story building was completed in 1896 at a cost of $20,000.

The building stone used here is a silty, light buff colored, porous dolomite of the Mississippian Sonora Formation. The stone reportedly was quarried from one of the long-abandoned quarries in the valley walls of Spillman Creek, about 3¼ miles southwest of the school site. The stone probably came from the quarry at Stop 3, known as the "Snake Den," and was brought to Dallas City by railroad.

Note the close fit of the stonework as well as the tool markings on the various stones. Two large cranes were reported to have been used in constructing the school.

The small creek, about 100 feet west of the route starting point, has eroded its channel downward into the upper part of the Keokuk Limestone of Mississippian age. The house on the south corner of Oak and Third Streets, a block away, may be very close to the top of the Keokuk. However, there and farther upstream to the south-southwest, surface deposits conceal the contact of the Keokuk with the overlying Warsaw Shale or Sonora Formation. Some of the units

of the Keokuk are fossiliferous. The best place to enter the creek is at the bridge where SR 9 crosses it.

STOP 2. Pleistocene deposits and underlying Mississippian bedrock strata in roadcuts, ditches, and stream cuts southeast and northwest from the Appanoose Cemetery T-road intersection [SW¼ SW¼ SW¼ NE¼ Sec. 14, T. 7 N., R. 8 W., 4th P.M., Hancock County; Niota 7.5-minute Quadrangle (40091E3)].

CAUTION - park off road as far as you can safely; FAST TRAFFIC. Some of the exposures along the creek are unstable so do **NOT** climb on them. Be careful what you take hold of to take home!

This stop affords the easiest access to Illinoian glacial till on the Dallas City field trip. On the east side of the macadam south of the T-road from the west, the following section is present beneath the grass-covered roadcut and in the ditch:

QUATERNARY SYSTEM

Pleistocene Series
Holocene Stage
Modern Soil - brownish-gray, friable; probably thickens farther upslope; 1 foot ±

Wiconsinan Stage
Woodfordian Substage
Peoria Loess - silt, slightly sandy, tan to brownish, soft, leached; appears to thicken southward toward the upland 2 feet ±

Sangamonian Stage
Sangamon Soil - accretion-gley, gray, with a pebble concentration up to 3 inches thick at the base; maximum thickness 3 feet

Illinoian Stage
Till - brownish-gray, hard, firm, slightly pebbly, limonite staining along jointing; not well exposed 6 feet

For additonal information see PLEISTOCENE GLACIATIONS IN ILLINOIS in the appendix.

The following bedrock strata are exposed along the west side of the macadam northward to the gravel road, and then continuing northwestward beyond the gravel road, roughly parallel to the macadam:

MISSISSIPPIAN SYSTEM

Valmeyeran Series

St. Louis Limestone - light gray, very fine-grained, algal limestone, hard, brecciated; lower part of formation frequently contains thick deposits of evaporites (gypsum and anhydrite) interbedded with the limestone; when evaporites were dissolved away the overlying strata collapsed forming the rough, jumbled, massive brecciated zones near the base of the formation; some of the brecciated blocks are up to 5 feet long; 12 feet ±

Sonora Formation - sandstone, medium-grained, slightly friable, cross-bedded, weathers orange, interbedded irregularly with sandy limestone containing abundant bryozoans and with greenish-gray sandy shale; 20 feet ±

Warsaw Shale - gray to bluish-gray shale containing beds of argillaceous limestone, fossiliferous with brachiopods, bryozoans, and crinoids abundant; geodes not found here, but are reported from adjacent areas; base concealed 25 feet ±

Some of the brecciated St. Louis Limestone shows up very well in an exposure just north of the house on the east side of the macadam.

STOP 3. Abandoned quarry in Mississippian Sonora Formation at the "Snake Den" [NE¼ NE¼ NE¼ extended Sec. 17, T. 7 N., R. 7 W., 4th P.M., Hancock County; Colusa 7.5-minute Quadrangle (40091E2)].

CAUTION - do **NOT** climb on the sides of this quarry. The face appears to be oversteepened and even overhanging in some places--in other words **UNSAFE.** Therefore, stay away from the face and examine the rubble, particularly toward the southwest side of the quarry.

The Valmeyeran Sonora Formation of middle Mississippian age is exposed at this long abandoned quarry and in a number of scattered exposures along Spillman Creek and its tributaries. Slumping of surficial materials generally has concealed these rocks except where they have been uncovered by stream erosion at the base of the steep slopes or where they have been quarried. A number of quarries were opened in the Sonora in this vicinity and several were known as the Lantry Quarries. The bedrock exposure at this Lantry Quarry, also known as the "Snake Den," follows:

MISSISSIPPIAN SYSTEM

Valmeyeran Series

Sonora Formation

Dolomite - tan with an orange cast from weathering, slightly sandy somewhat punky appearing near the top, thick-bedded in 2 to 5 foot thick beds; 40-45 feet

Dolomite - very similar to above, but massive-bedded; about 15 feet

Shale - tan with olive-green cast, contains a thin dolomite bed in the middle; 8 inches

Dolomite - tan with an orange cast, thick-bedded; 2-3 feet

Covered interval to floor of quarry; 2 feet ±

The thinner bedding in the upper part of the exposure may be a result of weathering. The Sonora is broken by irregular vertical joints, some of which contain deposits of tufa-like material. Calcite crystals occur in small cavities throughout the stone. The southwest part of the quarry has a number of large slumped or tumbled blocks of rock. Fossils do not appear to be common in this quarry.

The Sonora becomes more sandy southward and is a dolomitic sandstone in its type locality, about 12 miles to the southwest. It grades laterally into the Warsaw Shale.

When the quarries along Spillman Creek were operational, during the late 19th and very early 20th Centuries, a railroad spur was built southward from the Santa Fe (SF) Railroad mainline at Pontoosuc, about 1.5 miles to the north. This stone was extensively used for bridge abutments, foundations, general construction, etc. The stone was soft enough to be easily quarried and worked. It reportedly hardened after the loss of quarry water and upon exposure to the sun and air. As noted at Stop 1, the stone for the Dallas City High School reportedly came from the Lantry Quarry, also known as the "Snake Den." Quarrying operations ceased in the early 1900s when a flash flood destroyed the railroad bridge across Spillman Creek downstream from here.

NOTE: with this latter piece of information, you should look for analogous building situations along this creek. Would you feel secure in building on the low-lying valley flats along Spillman Creek?

STOP 4. Large glacial erratic in northwest corner of farmyard [Near NW corner Sec. 33, T. 7 N., R. 7 W., 4th P.M., Hancock County; Colusa 7.5-minute Quadrangle (40091E2)].

NOTE: Please obtain permission from the owner before you examine this boulder. CAUTION - do not block traffic while parked here!

The large boulder in this yard is a glacial erratic indicating by its name that it was brought to this area by one of the Pleistocene glaciers some time during the past million years or so. This type of rock is not native to this region, that is, it is not found in any of the bedrock strata in Illinois nor is it found in other areas close to our state. It most probably came from Canada or northern Minnesota.

A. H. Worthen, in his geological report on Hancock County (1866), told of a huge boulder "composed of the metamorphic rock of the northwest, which is nearly twenty feet in diameter. The power required to wrench such a mass of rock from its native bed and transport it, for hundreds of miles, with a force sufficient to obliterate all its angles, is inconceivably great..."

"Worthen's" erratic is mostly underwater now, but it is located not far from where this smaller specimen was found.

This rock is a CONGLOMERATE, a type of sedimentary rock made up of rounded pebbles and other fragments cemented together by silica and some iron oxide. It appears to be ancient because the smaller rocks are igneous and metamorphic rocks that have been weathered and abraded before they collected and were cemented together. There are no other sedimentary rocks in this boulder, indicating that there probably were none in that region. It is most likely Precambrian in age, perhaps being a billion years old or so.

This comglomerate is about 4 feet long by more than 3 feet wide by less than 3 feet tall. It weighs several thousand pounds based on the fact that an end-loader was unable to pick it up to load it into the truck that carried it here.

See ERRATICS ARE ERRATIC, Geogram 2, in the appendix for additional information. Be on the lookout for additional examples of erratics along the field trip route. Perhaps you can take an example home with you later today. Certainly not one this size, but at least a hand specimen.

STOP 5. Abandoned construction materials pit [NE¼ NW¼ SW¼ NE¼ Sec. 2, T. 7 N., R. 7 W., 4th P.M., Hancock County; Dallas City 7.5-minute Quadrangle (40091F2)].

CAUTION - do **NOT** climb on equipment or slopes adjacent to the exposed face. When parking, please do not block driveways.

This abandoned pit exposes nearly 50 feet of windblown silt called loess (rhymes with bus) of Wisconsinan age that has been named the Peoria Loess. It is a massive, well sorted silt that tends to be more coarse-grained here than on the uplands to the east and south. Except for the upper few feet, it is calcareous. Elsewhere it is as much as 100 feet thick adjacent to the large rivers but thins rapidly across the uplands to a foot or so several miles away. Fossil shells in the loess have been dated by their Carbon-14 content, which indicates a range in age from about 22,000 years B.P. (before present) to 12,000 years B.P. The Peoria Loess blankets the valley walls and uplands of most of Illinois beyond the area covered by Woodfordian glaciers (note the maps in the appendix; for more information about loess, see ANCIENT DUST STORMS IN ILLINOIS, Geogram 5, in the appendix).

The loess removed from this pit was used for fill material at nearby construction sites. Slumping of the face may be the result of construction that has taken place recently a short distance back from the top of the face. More water may be being injected from watering grass and shrubbery and from a septic field. If some of the material was removed during the winter, the new face formed did not have a chance to case-harden which then eventually results in failure of the face.

STOP 6. Lunch at Dallas City Recreation Park pavilion and discussion of Mississippi Valley history [SE¼ SE¼ SW¼ NW¼ Sec. 36, T. 8 N., R. 6 W., 4th P.M., Henderson County; Dallas City 7.5-minute Quadrangle (40091F2)].

The normal level of the Mississippi River here is controlled by Lock and Dam No. 19 at Keokuk, about 27 miles downstream. Normal pool elevation is 518 feet mean sea level (msl). The Mississippi is 1.25 miles wide from the shore at the park to the Iowa shoreline beyond Grape Island and Grape Chute. The navigation channel is about 0.5 mile from the park shore. The Mississippi Valley is about 6.5 miles wide here, with most of the flat developed on the Iowa side. In this area, as you have seen, the Illinois side of the valley is bounded by rock-supported bluffs, but on the Iowa side, the bluffs are cut entirely in glacial drift. From Fort Madison southward to Montrose (fig. 4), the west valley bluff swings in a great arc which at its maximum encompasses a valley flat that is about 5 miles wide.

Between Montrose, Iowa, and Nauvoo, Illinois, the river enters a narrow, rock-walled, rock-floored gorge barely wider than the river itself. Within the Keokuk Gorge, which is about 15 miles long and slightly less than 1 mile wide in some places, the river flows over bedrock, or at least it did before the Keokuk Dam was built. Over a stretch of 11 miles above Keokuk, the river flowed over a series of rapids cut into the Mississippian Keokuk Limestone. These rapids, in which the river had a fall of about 24 feet, presented an effective barrier to navigation. They were known as the "lower rapids" and also as the "Des Moines Rapids" after the Des Moines River which enters the Mississippi Valley just south of Keokuk. South of the mouth of the Des Moines River, the Mississippi Valley widens abruptly to about 8 miles.

The small size of the Keokuk Gorge in relation to the vast size of the valley above and below the rapids was first noted by geologists in the 1850s. At that time, they correctly recognized that the gorge was much younger than the wider portions of the valley. The idea developed during the latter part of the 1800s that a stream diversion had occurred as a result of glacial activity. The abandoned portion of the old valley, which is largely buried by glacial deposits, was discovered several miles to the west of the present gorge. This buried valley, partially reexcavated by the present Mississippi and its tributaries, the Skunk and Des Moines Rivers, extends in a great arc from north of Fort Madison to west of Keokuk (fig. 4). The old valley, with a width of more than 6 miles and a depth of nearly 300 feet, is approximately 10 times the size of the new gorge (fig. 5). The floor of the buried valley is 125 to 135 feet below the rock floor of the gorge.

Prior to the diversion which cut the Keokuk Gorge, the old valley was occupied by an ancestral stream called the Ancient Iowa River. The Ancient Iowa River joined the present Mississippi Valley near Muscatine and extended southward along a course approximately the same as that followed on the west side of Illinois by the present Mississippi River to Fort Madison (see appendix). The Ancient Mississippi followed a more easterly course, having cut a valley which entered Illinois at Fulton and extended it southeastward to the present "Big Bend" of the Illinois River near Hennepin. From there the Ancient Mississippi followed approximately the present course of the Illinois Valley to a junction with the Ancient Iowa Valley near Grafton in Calhoun County. Both the Ancient Iowa and Ancient Mississippi Rivers are believed to have originated as meltwater streams during the earlier Pleistocene glaciation(s).

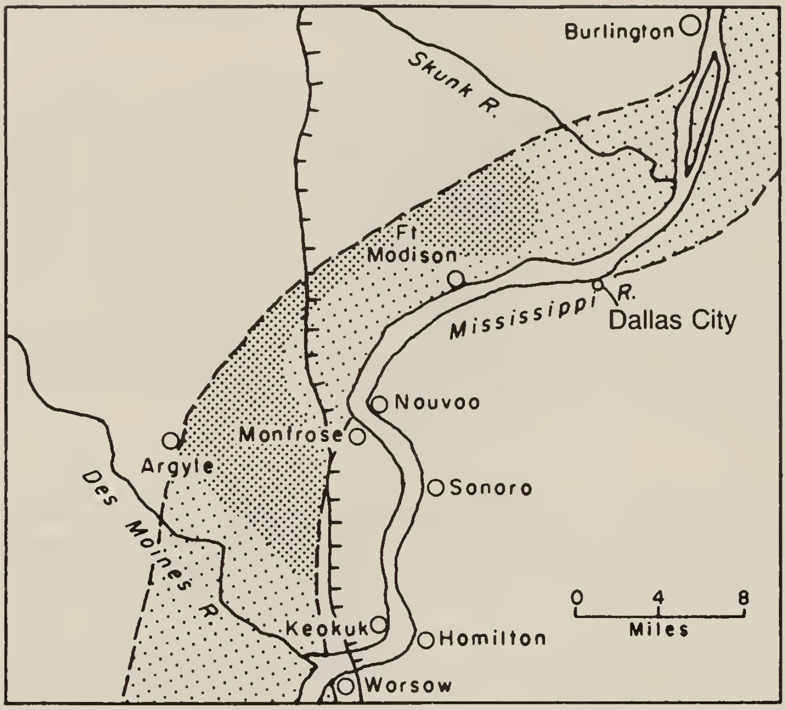


Figure 4. Sketch map showing the pre-Illinoian course of the Ancient Iowa Valley (wide-spaced dots within dashed lines) and the present course of the Mississippi River. The buried portion of the old valley is shown by the close-spaced dot pattern. The Illinoian glacial margin is shown by the hachured line. (Adapted from Leverett, 1899).

Figure 5. Cross section of abandoned Ancient Iowa Valley and present Mississippi Valley from Argyle, Iowa, to Sonora, Illinois. Thick glacial deposits in the buried valley are shown by the close-spaced pattern of dots. (From Iowa Geological Survey in Leverett, 1899).

The diversion of the Ancient Iowa River, which cut the lower rapids, is believed to have occurred as a result of a pre-Illinoian glaciation from the northwest, because the drift which fills the abandoned portion of the valley is mostly of that age. In the bluffs on the Iowa side at Fort Madison, 100 feet of pre-Illinoian till is exposed. The Illinoian glacier covered only part of the old valley at its maximum advance from the northeast. At the maximum extent of the pre-Illinoian glaciation, the Ancient Iowa Valley along most of its course was completely covered by the ice, and drainage was diverted eastward into the Ancient Mississippi Valley (see appendix). As the pre-Illinoian glacier melted back, the Ancient Iowa River re-occupied most of its pre-Illinoian valley, but the loop of the valley westward from Nauvoo to below Keokuk was blocked by the ice long enough for the diverted river to entrench itself into the bedrock forming the Keokuk Gorge.

During the Illinois glaciation the Ancient Iowa and the Mississippi Rivers were again forced from their valleys to a westerly course in Iowa. However, this Illinoian diversion was only temporary, and when the ice front melted back, both rivers resumed their previous courses. The Keokuk Gorge was deepened by meltwaters as the river eroded its valley during the Illinoian and Wisconsinan glaciations. During the Woodfordian advance of the Wisconsian glaciation (see appendix), the Ancient Mississippi River was forced westward and permanently diverted into the Ancient Iowa Valley when meltwater over-topped another bedrock divide at Cordova in Rock Island County. The Ancient Mississippi Valley to the Big Bend was buried by drift and permanently aban-doned. The Illinois River then assumed the valley of the Ancient Mississippi to the south.

STOP 7. View of Illinoian till plain from upper part of Gittings Mound [SE corner SW¼ Sec. 35, T. 8 N., R. 6 W., 4th P.M., Henderson County; Lomax 7.5-minute Quadrangle (40091F1)].

CAUTION - do **NOT** block driveways!

Gittings Mound affords the best view across part of the Illinoian till plain on the field trip from our stop, about 750 feet msl. The high point on the mound is 759 feet msl, about 500 feet north-northeast from here. To the southeast, east, and north, the surface of the Illinoian till plain is 50 to 70 feet below us. The mound is 90 to 100 feet above the Illinoian till plain to the southwest and west.

Although at one time the mound was thought to be underlain by bedrock with a thin veneer of glacial materials on top, a well drilled (1945) a little more than 1/4 mile to the west-northwest from here does not support that concept. The driller's log indicated 90 feet of clay above bedrock. The driller's log of another well drilled (1941) about a mile to the south-southwest indicates 60 feet of clay and 10 feet of sand above bedrock.

Gittings Mound is an ice-contact feature, that is, it most likely is a cre-vasse filling that formed when the glacier was stagnant. Meltwater poured into the crevasse dumping part of its load of sand, gravel, and silt that the ice had been carrying. When the ice had melted away enough to no longer give support to this material in the crevasse, it sagged and spread out in this elongate mound. Another smaller mound lies to the northeast which also lends

support to the idea of this being a crevasse filling. In other words, there were several of these mounds that developed along the crevasse, some being small are barely discernible now because of loess cover and erosion after loess deposition.

The material forming the mound is the Hagarstown Member of the Illinoian Glasford Formation. The Hagarstown Member is mostly well-sorted and well-bedded sand and gravel with some till blocks, that are cemented locally. It may occur in kames, eskers, and crevasse fillings. Here it overlies the Kellerville Till Member of the Liman Substage, the oldest Illinoian glacial substage. Ten to 15 feet of Peoria Loess blankets the Hagarstown and Kellerville in this vicinity.

STOP 8. Roadcut exposure of Wisconsinan Peoria Loess and nearby noncompliance refuse disposal [Ctr S edge SE¼ SE¼ SW¼ Sec. 33, T. 8 N., R. 6 W., 4th P.M., Henderson County: Lomax 7.5-minute Quadrangle (40091F1)].

CAUTION - do **NOT** block traffic. Be careful!

About 10 feet of Wisconsinan Peoria Loess is exposed in this roadcut; the upper half of which contains the modern soil. The lower half is gray and brown mottled, contains limonite tubules, and is separated from the upper half by a 2 to 3 inch band of iron-stained materials. The loess is somewhat finer here than at Stop 5. The lower portion of the exposure may represent a zone of high water saturation over a long time period with the oxidation of the iron taking place at the top of the zone of saturation. This high level of water saturation predated clearing the land for livestock and/or crops. Clearing the land right up to the sharp, steep valley walls has removed the protective plant cover and resulted in severe erosion in this area.

On the west side of the loess exposure is an example of blatant noncompliance refuse disposal. Initially, perhaps, material was dumped here to protect the road fill. All too frequently in that type of situation, the main thing that is accomplished is to overload the slope and increase its instability. This leads to further slumping followed by the addition of more material in the hopes of eventually getting the fill stabilized. It appears likely that the loess that has been skinned off the exposure has been used to raise the road grade across this small stream valley. The loess, because of its extreme fineness, is not a good fill material by itself and this has undoubtedly been the cause of at least part of the problem here.

Initially, the intentions regarding the placement of material, west of the roadcut along the north side of the roadway, may have been very good. However, once some individuals see dumping of "construction" materials for whatever purpose, they see this as a green light to dump any and all types of refuse there, too. "After all, they'll probably add some more dirt and cover up what I have left." The clayey glacial till that occurs between this refuse and the underlying bedrock probably will slow down the infiltration of polluted water into the bedrock beneath the site. However, polluted water flowing from the site will encounter the open joint system of the underlying limestone and dolomite bedrock only a short distance downstream. Once into the joint system, the polluted water becomes part of our groundwater supplies. The remainder of the polluted water, that does not enter the

groundwater system, will flow into the Mississippi River, the source of drinking water for many communities downstream.

STOP 9. Roadcut exposure of Wisconsinan Parkland Sand [W edge extended NW¼ NW¼ NW¼ Sec. 32, T. 8 N., R. 6 W., 4th P.M., Henderson County; Lomax 7.5-minute Quadrangle (40091F1)].

The Wisconsinan Parkland Sand has been exposed by the roadcut through a small dune. It is a wind-blown, well-sorted, medium-grained sand that occurs in small dunes locally in the field trip area. As meltwater from the waning Wisconsinan glaciers subsided in the Mississippi Valley, the vast valley train deposits were exposed to the drying wind from the northwest. The wind winnowed out the sand and silt from the valley trains and carried these finer materials away. However, when the air currents rose along the valley walls, the wind was unable to carry all of its load. The coarsest material was dropped first, thus explaining the sand dunes proximity to the valley walls. As mentioned previously, the finer material was carried for much greater distances across the upland, where it eventually dropped.

The dunes here are not very large, being perhaps 20 feet high at the most and not covering a very large area. Some dunes appear as tree-covered hillocks. Some of the dunes in this vicinity have been stabilized by vegetation; others have had the vegetation destroyed by farming or by opening sand pits. Some of the dunes have been the source for construction sand.

As we proceed northward along this narrow road, you will have the opportunity to see how landforms, limited outcrops, springs and seeps, etc., can be used by the field geologist in his attempts to decipher the geology of an area. About ¼-mile north of here, we will be close to the Mississippi Valley wall, and will leave the Parkland Sand dunes, and will drive down through about 50 feet of Peoria Loess, which maintains good, nearly vertical walls down the narrow, steep, long part of the roadcut. The narrowness of the cut and the relatively undisturbed vegetation on both sides have helped to protect the cut from direct, heavy rainfall, which would have led to slumping of the sides. This cut is reminiscent of the countless roadcuts in the Midwest that were worn down through the bluffs by teams of horses pulling heavy wagons and buggies before the advent of the large mechanical road graders and scrapers.

If a large enough quantity of the small fossil snail shells noted in this loess can be collected, then, it may be possible to do a Carbon-14 (C-14) determination in the laboratory. Farther down the cut, there is a change in slope--it gets steeper. This may indicate the presence of the Wisconsinan Roxana Silt, a finer grained, more compact silt than the Peoria Loess. Still farther down the slope, a seepage zone is encountered that well may indicate the presence of the clayey, compact Illinoian Kellerville Till, through which the water cannot pass. The till may show the Sangamonian Soil in its upper part.

Where the road flattens out across a short bench, the Mississippian Keokuk-Burlington Limestones are at the surface, as indicated by pieces of limestone "float" in the ditches. A view to the left (west) across the fence does, indeed, show an abandoned quarry in the Keokuk-Burlington. The road drops rapidly beyond the bench, down through shallow cuts that expose ledges of the underlying limestone bedrock as you approach the highway.

STOP 10. Discussion of Pleistocene terrace levels [E side of Carman Road NW¼ SW¼ SW¼ NE¼ Sec. 10, T. 8 N., R. 6 W., 4th P.M., Henderson County (40091F1)].

CAUTION - park as far off the road as you can. **LOOK BEFORE** you open your car door on the roadside. **FAST TRAFFIC!**

The village of Lomax, about 1.25 miles south of this stop, is located on a high terrace with an elevation of about 550 feet msl. This terrace was formed when the meltwater-swollen Mississippi River dropped its heavy load of glacial outwash debris along the valley sides as melting of the glacier waned. These upper terrace deposits were reworked by a later less high level of water that scoured some of the material away to leave a lower terrace at an elevation of about 535 msl.

The scarp between the upper terrace, on the east, and the lower terrace, on the west, is quite prominent. We are standing on the lower terrace. To the southeast and to the northeast, sand dunes are found along the edge of the higher terrace. They are fairly common farther back on the high terrace, also. Farther west, the present floodplain has been cut into the lower terrace. The floodplain has an elevation of about 523 feet msl, below which is the Keokuk Pool of the Mississippi at a normal pool elevation of 518 msl.

Below the land surface, the valley-fill deposits, although variable, are predominantly sand. However, about 20 to 30 feet of sandy clay underlies the floodplain. In general, the valley-fill deposits become coarser-grained with depth, and a boulder lag concentrate may be present on the bedrock surface. The lower 50 feet or so, usually contains small to moderate amounts of gravel. The sandy valley-fill deposits are the source of the water used by the pivot-irrigation systems northeast of Lomax on the high terrace. Such wells usually test 1,000 to 2,000 gallons per minute (gpm).

STOP 11. Discussion of Pleistocene Lomax Section: rock collecting from gravel bars in Honey Creek [SE¼ SW¼ SW¼ Sec. 12, T. 8 N., R. 6 W., 4th P.M., Henderson County; Lomax 7.5-minute Quadrangle (40091F1)].

NOTE - you **MUST HAVE** permission to enter this property. Please make sure that all gates are closed while you are working here **AND** when you leave!

The upper 50 feet or so of this exposure consists of Peoria Loess that contains a number of large sand lenses. Beneath the loess is a 4 foot interval of organic-rich sand and peat, the upper part of which has been radio-carbon dated at about 20,300 years B.P. This may represent a time of widespread peat bogs because there are a number that occur at about this same elevation in the valley as it existed during early Woodfordian time, before the Ancient Mississippi River was diverted from its course through central Illinois.

Beneath the organic sand and peat zone, the silts and sands may be Altonian in age and their underlying till may be Illinoian or older.

The west-facing scarps here apparently do not get enough intense heat to help case-harden them, as they would were they facing south. Therefore, there is a

lot of slumping that goes on along the creek through this area. The landowner, in consultation with the local Soil Conservation Service, has engaged in some reclamation projects in an attempt to mitigate the effects of erosion on his property. Some high-level dams have been constructed to catch and retain rainfall, which is then conducted down to the creek through buried steel conduits. You can see that the one slope from here looks good now. It will be interesting to observe, over the course of the next few years, to see how this slope holds up.

There is good rock collecting from the gravel bars in Honey Creek. You may find some small geodes, but most will be solid.

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Urbana, Illinois 61801

GEOGRAM 2
October 1974

ERRATICS ARE ERRATIC

Myrna M. Killey

You may have seen them scattered here and there in Illinois—boulders, some large, some small, lying alone or with a few companions in the corner of a field, at the edge of a road, in someone's yard, or perhaps on a courthouse lawn or schoolyard. Many of them seem out of place, like rough, alien monuments in the stoneless, grassy knolls and prairies of our state. Some—the colorful and glittering granites, banded gneisses, and other intricately veined and streaked igneous and metamorphic rocks--are indeed foreign rocks, for they came from Canada and the states north of us. Others—gray and tan sedimentary rocks—are native rocks and may be no more than a few miles from their place of origin. All of these rocks are glacial boulders that were moved to their present sites by massive ice sheets that flowed across our state. If these boulders are unlike the rocks in the quarries and outcrops in the region where they are found, they are called erratics.

The continental glaciers of the Great Ice Age scoured and scraped the land surface as they advanced, pushing up chunks of bedrock and grinding them against each other or along the ground surface as the rock-laden ice sheets pushed southward. Hundreds of miles of such grinding, even on such hard rocks as granite, eventually rounded off the sharp edges of these passengers in the ice until they became the rounded, irregular boulders we see today. Although we do not know the precise manner in which erratics reached their present isolated sites, many were probably dropped directly from the melting front of a glacier. Others may have been rafted to their present resting places by icebergs on ancient lakes or on the floodwaters of some long-vanished stream as it poured from a glacier. Still others, buried in the glacial deposits, could have worked their way up to the land surface as the surrounding loose soil repeatedly froze and thawed. When the freezing ground expands, pieces of rock tend to be pushed upward, where they are more easily reached by the farmer's plow and also more likely to be exposed by erosion.

An eight-foot boulder of pink granite left by a glacier in the bed of a creek about 5 miles southwest of Alexis, Warren County, Illinois. (From ISGS Bulletin 57, 1929.)

Generally speaking, erratics found northeast of a line drawn from Freeport in Stephenson County, southward through Peoria, and then southeastward through Shelbyville to Marshall at the east edge of the state were brought in by the last glacier to enter Illinois. This glaciation, called the Wisconsinan, spread southwestward into Illinois from a center in eastern Canada, reaching our state about 75,000 years ago and (after repeated advances and retreats of the ice margin) melting from the state about 12,500 years ago. Erratics to the west or south of the great arc outlined above were brought in by a much older glacier, the Illinoian, which spread over most of the state about 300,000 to 175,000 years ago. Some erratics were brought in by even older glaciers that came from the northwest.

You may be able to locate some erratics in your neighborhood. Sometimes it is possible to tell where the rock originally came from by determining the kind of rock it is. A large boulder of granite, gneiss, or other igneous or metamorphic rock may have come from the Canadian Shield, a vast area in central and eastern Canada where rocks of Precambrian age (more than 600 million years old) are exposed at the surface. Some erratics containing flecks of copper were probably transported here from the "Copper Range" of the upper peninsula of Michigan. Large pieces of copper have been found in glacial deposits of central and northern Illinois. Light gray to white quartzite boulders with beautiful, rounded pebbles of red jasper came from a very small outcrop area near Bruce Mines, Ontario, Canada. Purplish pieces of quartzite, some of them banded, probably originated in the Baraboo Range of central Wisconsin. Most interesting of all are the few large boulders of Canadian tillite. Tillite is lithified (hardened into rock) glacial till deposited by a Precambrian glacier many millions of years older than the ones that invaded our state a mere few thousand years ago. Glacial till is an unsorted and unlayered mixture of clay, sand, gravel, and boulders that vary widely in size and shape. Tillite is a gray to greenish gray rock containing a mixture of grains of different sizes and scattered pebbles of various types and sizes.

Many erratics are of notable size and beauty, and in parts of Illinois they are commonly used in landscaping. Some are used as monuments in courthouse squares, in parks, or along highways. Many are marked with metal plaques to indicate an interesting historical spot or event. Keep an eye out for erratics. There may be some of these glacial strangers in your neighborhood that would be interesting to know.

ILLINOIS STATE GEOLOGICAL SURVEY
Urbana, Illinois 61801

ANCIENT DUST STORMS IN ILLINOIS

Myrna M. Killey

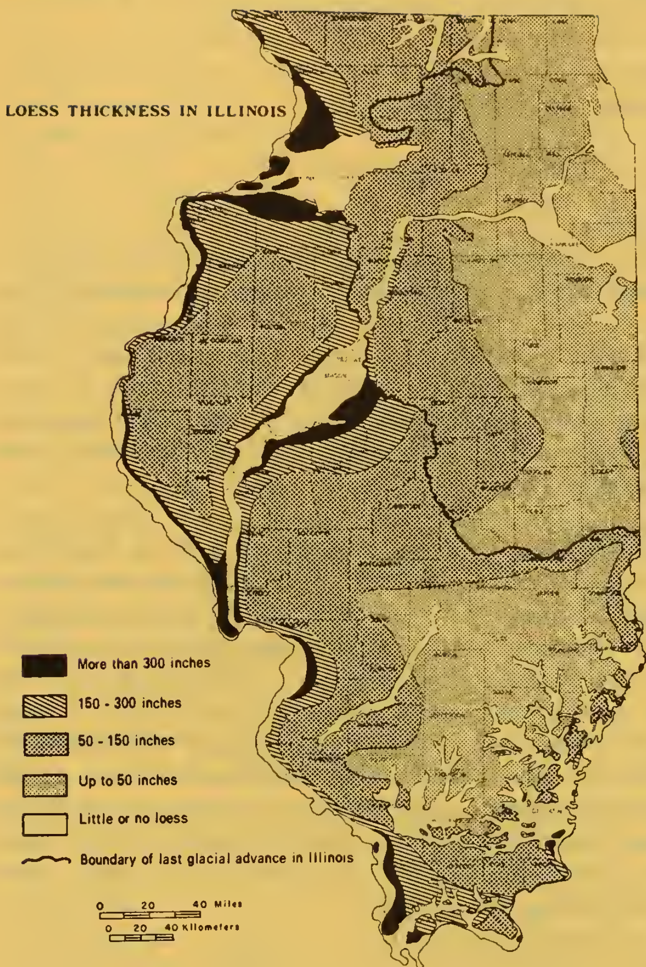
Fierce dust storms whirled across Illinois long before human beings were here to record them. Where did all the dust come from? Geologists have carefully put together clues from the earth itself to get the story. As the glaciers of the Great Ice Age scraped and scoured their way southward across the landscape from Canada, they moved colossal amounts of rock and earth. Much of the rock ground from the surface was kneaded into the ice and carried along, often for hundreds of miles. The glaciers acted as giant grist mills, grinding much of the rock and earth to "flour"—very fine dust-sized particles.

During the warm seasons, water from the melting ice poured from the glacier front, laden with this rock flour, called silt. In the cold months the meltwater stopped flowing and the silt was left along the channels the water had followed, where it dried out and became dust. Strong winds picked up the dust, swept it from the floodplains, and carried it to adjacent uplands. There the forests along the river valleys trapped the dust, which became part of the moist forest soil. With each storm more material accumulated until the high bluffs adjacent to major rivers were formed. The dust deposits are thicker along the eastern sides of the valleys than they are on the western sides, a fact from which geologists deduce that the prevailing winds of that time blew from west to east, the same direction as those of today. From such clues geologists conclude that the geologic processes of the past were much like those of today.

The deposits of windblown silt are called loess (rhymes with "bus"). Loess is found not only in the areas once covered by the glaciers but has been blown into the nonglaciated areas. The glaciers, therefore, influenced the present land surface well beyond the line of their farthest advance.

Loess has several interesting characteristics. Its texture is so fine and uniform that it can easily be identified in roadcuts—and because it blankets such a vast area many roads are cut through it. Even more noticeable is its tendency to stand in vertical walls. These steep walls develop as th loess drains and becomes tough, compact, and massive, much like a rock. Sometimes cracks develop in the loess, just as they do in massive limestones and sandstones. Loess makes good highway banks if it is cut vertically. A vertical cut permits maximum drainage because little surface is exposed to rain, and rainwater tends to drain straight down through it to the rock underneath. If the bank is cut at an angle more water soaks in, which causes the loess to slump down. Along Illinois roads the difference between a loess roadcut and one in ordinary glacial till is obvious. The loess has a very uniform texture, while the till is composed of a random mixture of rock debris, from clay and silt through cobbles and boulders.

Many loess deposits are worth a close look. Through a 10-power hand lens separate grains can be seen, among them many clear, glassy, quartz grains. Some loess deposits contain numerous rounded, lumpy stones called concretions. Their formation began when water percolating through the loess dissolved tiny



limestone grains. Some of the dissolved minerals later became solid again, gathering around a tiny nucleus or along roots to form the lumpy masses. A few such concretions are shaped roughly like small dolls and, from this resemblance, are called "loess kindchen," a German term meaning "loess children." They may be partly hollow and contain smaller lumps that make them rattle when shaken.

Fossil snails can be found in some loess deposits. The snails lived on the river bluffs while the loess was being deposited and were buried by the dust. When they are abundant, they are used to determine how old the loess is. The age is found by measuring the amount of radioactive carbon in the calcium carbonate of their shells.

Some of the early loess deposits were covered by new layers of loess following later glacial invasions. Many thousands of years passed between the major glacial periods, during which time the climate was as warm as that of today. During the warm intervals, the surface of the loess and other glacial deposits was exposed to weather. Soils developed on most of the terrain, altering the composition, color, and texture of the glacial material. During later advances of the ice, some of these soils were destroyed, but in many places they are preserved under the younger sediments. Such ancient buried soils can be used to determine when the materials above and below them were laid down by the ice and what changes in climate took place.

The blanket of loess deposited by the ancient dust storms forms the parent material of the rich, deep soils that today are basic to the state's agriculture. A soil made of loess crumbles easily and has great moisture-holding capacity. It also is free from rocks that might complicate cultivation. Those great dust storms that swirled over the land many thousands of years ago thus endowed Illinois with one of its greatest resources, its highly productive soil.

PLEISTOCENE GLACIATIONS IN ILLINOIS

Origin of the Glaciers

During the past million years or so, the period of time called the Pleistocene Epoch, most of the northern hemisphere above the 50th parallel has been repeatedly covered by glacial ice. Ice sheets formed in sub-arctic regions four different times and spread outward until they covered the northern parts of Europe and North America. In North America the four glaciations, in order of occurrence from the oldest to the youngest, are called the Nebraskan, Kansan, Illinoian, and Wisconsinan Stages of the Pleistocene Epoch. The limits and times of the ice movement in Illinois are illustrated in the following pages by several figures.

The North American ice sheets developed during periods when the mean annual temperature was perhaps 4° to 7° C (7° to 13° F) cooler than it is now and winter snows did not completely melt during the summers. Because the cooler periods lasted tens of thousands of years, thick masses of snow and ice accumulated to form glaciers. As the ice thickened, the great weight of the ice and snow caused them to flow outward at their margins, often for hundreds of miles. As the ice sheets expanded, the areas in which snow accumulated probably also increased in extent.

Tongues of ice, called lobes, flowed southward from the Canadian centers near Hudson Bay and converged in the central lowland between the Appalachian and Rocky Mountains. There the glaciers made their farthest advances to the south. The sketch below shows several centers of flow, the general directions of flow from the centers, and the southern extent of glaciation. Because Illinois lies entirely in the central lowland, it has been invaded by glaciers from every center.

Effects of Glaciation

Pleistocene glaciers and the waters melting from them changed the landscapes they covered. The glaciers scraped and smeared the landforms they overrode, leveling and filling many of the minor valleys and even some of the larger ones. Moving ice carried colossal amounts of rock and earth, for much of what the glaciers wore off the ground was kneaded into the moving ice and carried along, often for hundreds of miles.

The continual floods released by melting ice entrenched new drainageways, deepened old ones, and then partly refilled both with sediments as great quantities of rock and earth were carried beyond the glacier fronts. According to some estimates, the amount of water drawn from the sea and changed into ice during a glaciation was probably enough to lower sea level more than 300 feet below present level. Consequently, the melting of a continental ice sheet provided a tremendous volume of water that eroded and transported sediments.

In most of Illinois, then, glacial and meltwater deposits buried the old rock-ribbed, low, hill-and-valley terrain and created the flatter landforms of our prairies. The mantle of soil material and the deposits of gravel, sand, and clay left by the glaciers over about 90 percent of the state have been of incalculable value to Illinois residents.

Glacial Deposits

The deposits of earth and rock materials moved by a glacier and deposited in the area once covered by the glacier are collectively called drift. Drift that is ice-laid is called till. Water-laid drift is called outwash.

Till is deposited when a glacier melts and the rock material it carries is dropped. Because this sediment is not moved much by water, a till is unsorted, containing particles of different sizes and compositions. It is also unstratified (unlayered). A till may contain materials ranging in size from microscopic clay particles to large boulders. Most tills in Illinois are pebbly clays with only a few boulders.

Tills may be deposited as end moraines, the arc-shaped ridges that pile up along the glacier edges where the flowing ice is melting as fast as it moves forward. Till also may be deposited as ground moraines, or till plains, which are gently undulating sheets deposited when the ice front melts back, or retreats. Deposits of till identify areas once covered by glaciers. Northeastern Illinois has many alternating ridges and plains, which are the succession of end moraines and till plains deposited by the Wisconsinan glacier.

Sorted and stratified sediment deposited by water melting from the glacier is called outwash. Outwash is bedded, or layered, because the flow of water that deposited it varied in gradient, volume, velocity, and direction. As a meltwater stream washes the rock materials along, it sorts them by size--the fine sands, silts, and clays are carried farther downstream than the coarser gravels and cobbles. Typical Pleistocene outwash in Illinois is in multilayered beds of clays, silts, sands, and gravels that look much like modern stream deposits.

Outwash deposits are found not only in the area covered by the ice field but sometimes far beyond it. Meltwater streams ran off the top of the glacier, in crevices in the ice, and under the ice. In some places, the cobble-gravel-sand filling of the bed of a stream that flowed in the ice is preserved as a sinuous ridge called an esker. Cone-shaped mounds of coarse outwash, called kames, were formed where meltwater plunged through crevasses in the ice or into ponds along the edge of the glacier.

The finest outwash sediments, the clays and silts, formed bedded deposits in the ponds and lakes that filled glacier-dammed stream valleys, the sags of the till plains, and some low, moraine-diked till plains. Meltwater streams that entered a lake quickly lost speed and almost immediately dropped the sands and gravels they carried, forming deltas at the edge of the lake. Very fine sand and silts were moved across the lake bottom by wind-generated

currents, and the clays, which stayed in suspension longest, slowly settled out and accumulated with them.

Along the ice front, meltwater ran off in innumerable shifting and short-lived streams that laid down a broad, flat blanket of outwash that formed an outwash plain. Outwash was also carried away from the glacier in valleys cut by floods of meltwater. The Mississippi, Illinois, and Ohio Rivers occupy valleys that were major channels for meltwaters and were greatly widened and deepened during times of the greatest meltwater floods. When the floods waned, these valleys were partly filled with outwash far beyond the ice margins. Such outwash deposits, largely sand and gravel, are known as valley trains. Valley trains may be both extensive and thick deposits. For instance, the long valley train of the Mississippi Valley is locally as much as 200 feet thick.

Loess and Soils

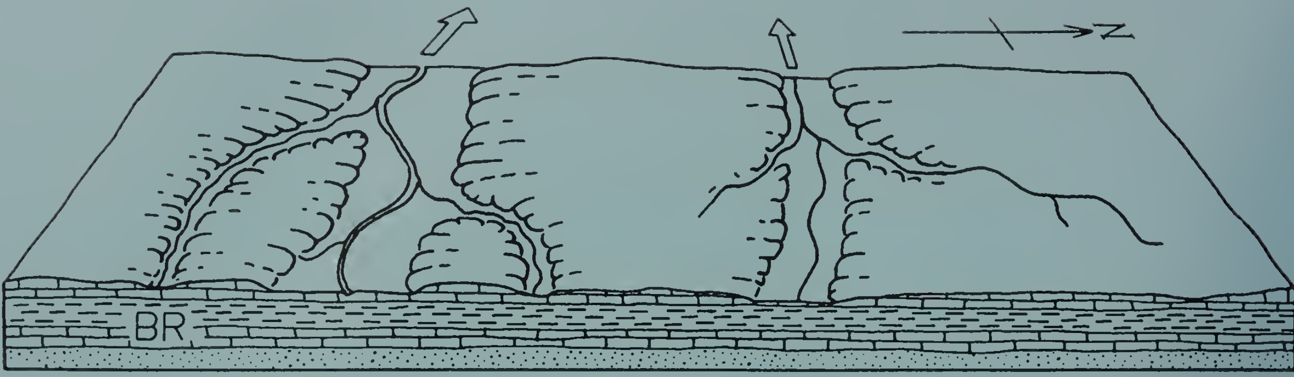
One of the most widespread sediments resulting from glaciation was carried not by ice or water but by wind. Loess is the name given to such deposits of windblown silt and clay. The silt was blown from the valley trains on the floodplains. Most loess deposition occurred in the fall and winter seasons when low temperatures caused meltwater floods to abate, exposing the surfaces of the valley trains and permitting them to dry out. During Pleistocene time, as now, west winds prevailed, and the loess deposits are thickest on the east sides of the source valleys. The loess thins rapidly away from the valleys but extends over almost all the state.

Each Pleistocene glaciation was followed by an interglacial stage that began when the climate warmed enough to melt the glaciers and their snowfields. During these warmer intervals, when the climate was similar to that of today, drift and loess surfaces were exposed to weather and the activities of living things. Consequently, over most of the glaciated terrain, soils developed on the Pleistocene deposits and altered their composition, color, and texture. Such soils were generally destroyed by later glacial advances, but those that survive serve as keys to the identity of the beds and are evidence of the passage of a long interval of time.

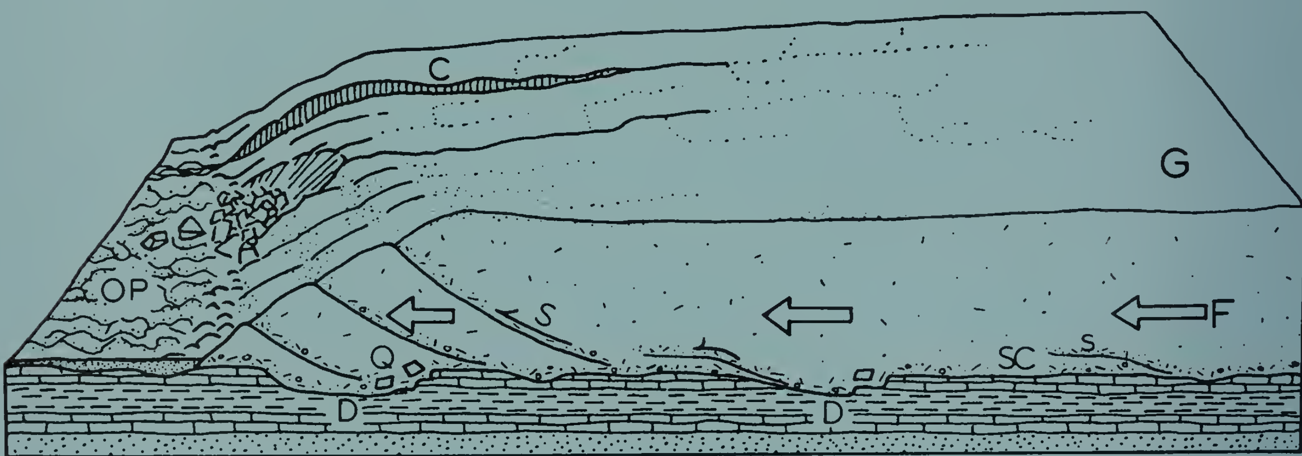
Glaciation in a Small Illinois Region

The following diagrams show how a continental ice sheet might have looked as it moved across a small region in Illinois. They illustrate how it could change the old terrain and create a landscape like the one we live on. To visualize how these glaciers looked, geologists study the landforms and materials left in the glaciated regions and also the present-day mountain glaciers and polar ice caps.

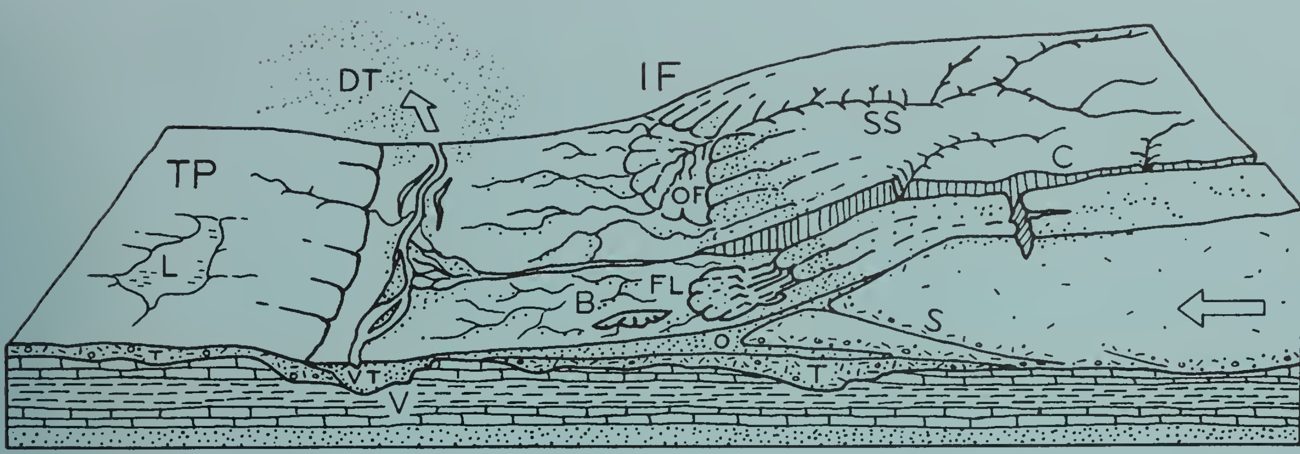
The block of land in the diagrams is several miles wide and about 10 miles long. The vertical scale is exaggerated--layers of material are drawn thicker and landforms higher than they ought to be so that they can be easily seen.



1. The Region Before Glaciation - Like most of Illinois, the region illustrated is underlain by almost flat-lying beds of sedimentary rocks--layers of sandstone ( ), limestone ( ), and shale ( ). Millions of years of erosion have planed down the bedrock (BR), creating a terrain of low uplands and shallow valleys. A residual soil weathered from local rock debris covers the area but is too thin to be shown in the drawing. The streams illustrated here flow westward and the one on the right flows into the other at a point beyond the diagram.



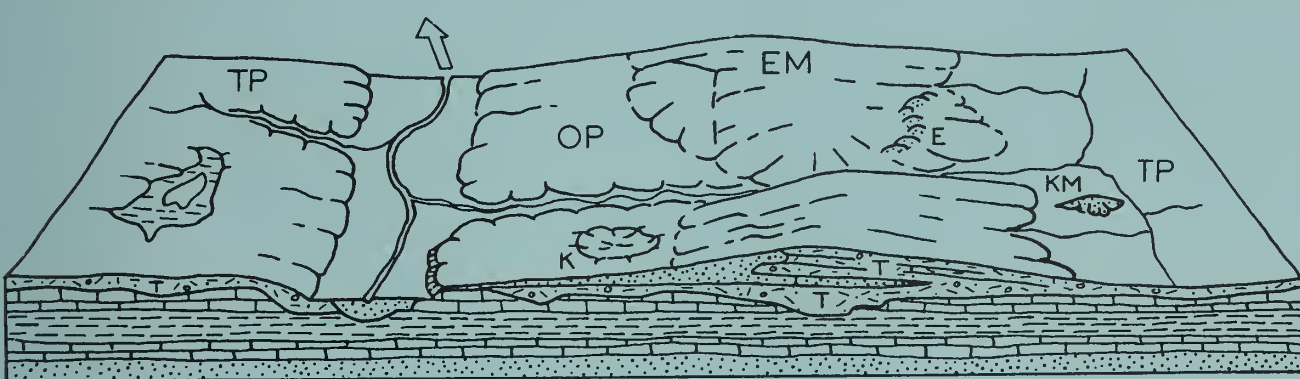
2. The Glacier Advances Southward - As the glacier (G) spreads out from its snowfield, it scours (SC) the soil and rock surface and quarries (Q)--pushes and plucks up--chunks of bedrock. These materials are mixed into the ice and make up the glacier's "load." Where roughnesses in the terrain slow or stop flow (F), the ice "current" slides up over the blocked ice on innumerable shear planes (S). Shearing mixes the load very thoroughly. As the glacier spreads, long cracks called "crevasses" (C) open parallel to the direction of ice flow. The glacier melts as it flows forward, and its meltwater erodes the terrain in front of the ice, deepening (D) some old valleys before the ice covers them. Meltwater washes away some of the load freed by melting and deposits it on the outwash plain (OP). The advancing glacier overrides its outwash and in places scours much of it up again. The glacier may be 5000 or so feet thick , except near its margin. Its ice front advances perhaps as much as a third of a mile per year.



3. <u>The Glacier Deposits an End Moraine</u> - After the glacier advanced across the area, the climate warmed and the ice began to melt as fast as it advanced. The ice front (IF) is now stationary, or fluctuating in a narrow area, and the glacier is depositing an end moraine.

As the top of the glacier melts, some of the sediment that was mixed in the ice accumulates on top of the glacier. Some is carried by meltwater onto the sloping ice front (IF) and out onto the plain beyond. Some of the debris slips down the ice front in a mudflow (FL). Meltwater runs through the ice in a crevasse (C). A superglacial stream (SS) drains the top of the ice, forming an outwash fan (OF). Moving ice has overridden an immobile part of the front on a shear plane (S). All but the top of a block of ice (B) is buried by outwash (O).

Sediment from the melted ice of the previous advance (figure 2) was left as a till layer (T), part of which forms the till plain (TP). A shallow, marshy lake (L) fills a low place in the plain. Although largely filled with drift, the valley (V) remained a low spot in the terrain. As soon as its ice cover melted, meltwater drained down the valley, cutting it deeper. Later, outwash partly refilled the valley--the outwash deposit is called a valley train (VT). Wind blows dust (DT) off the dry floodplain. The dust will form a loess deposit when it settles.



4. <u>The Region after Glaciation</u> - The climate has warmed even more, the whole ice sheet has melted, and the glaciation has ended. The end moraine (EM) is a low, broad ridge between the outwash plain (OP) and till plains (TP). Run-off from rains cuts stream valleys into its slopes. A stream goes through the end moraine along the channel cut by the meltwater that ran out of the crevasse in the glacier.

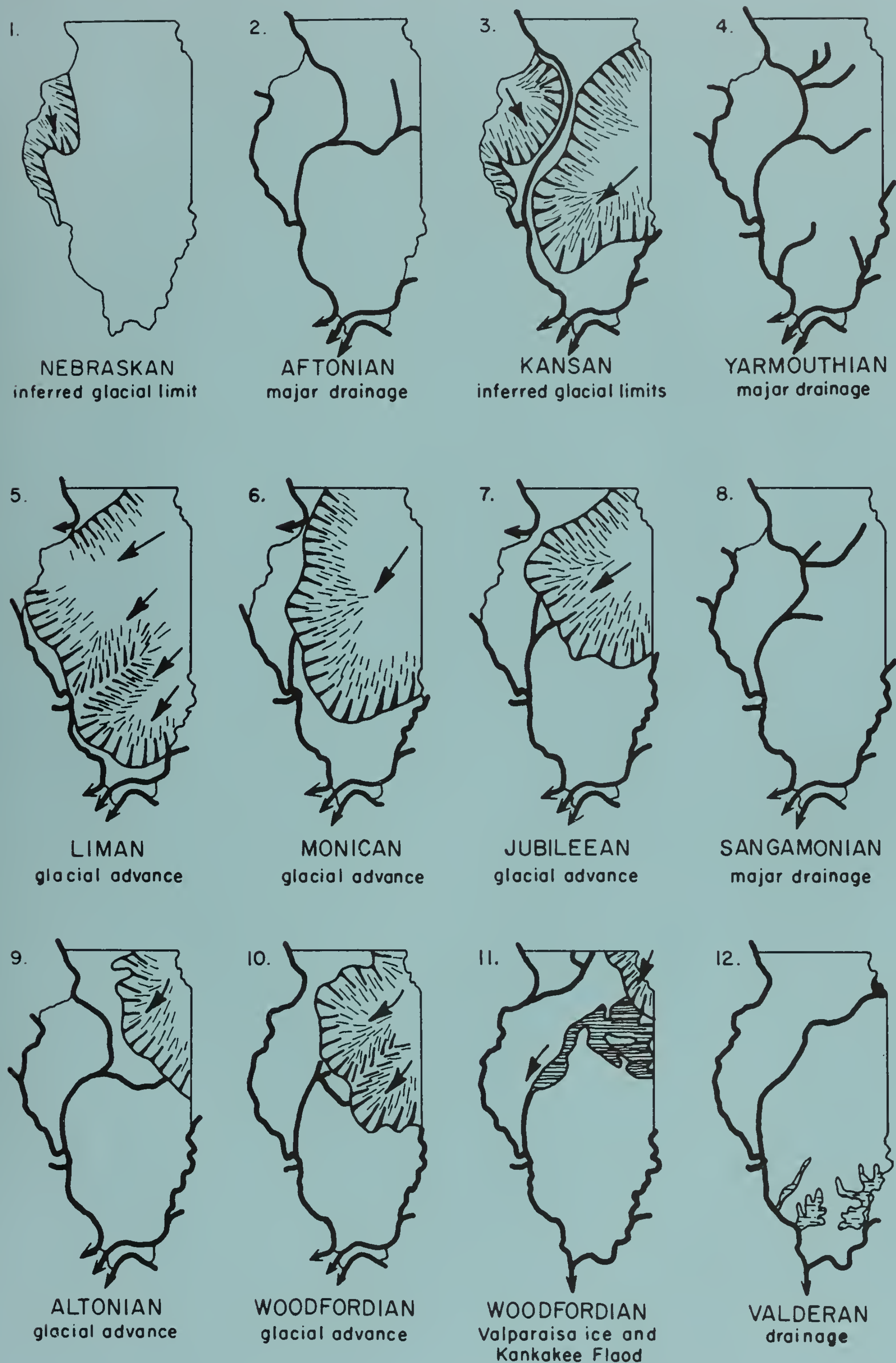
Slopewash and vegetation are filling the shallow lake. The collapse of outwash into the cavity left by the ice block's melting has made a kettle (K). The outwash that filled a tunnel draining under the glacier is preserved in an esker (E). The hill of outwash left where meltwater dumped sand and gravel into a crevasse or other depression in the glacier or at its edge is a kame (KM). A few feet of loess covers the entire area but cannot be shown at this scale.

TIME TABLE OF PLEISTOCENE GLACIATION

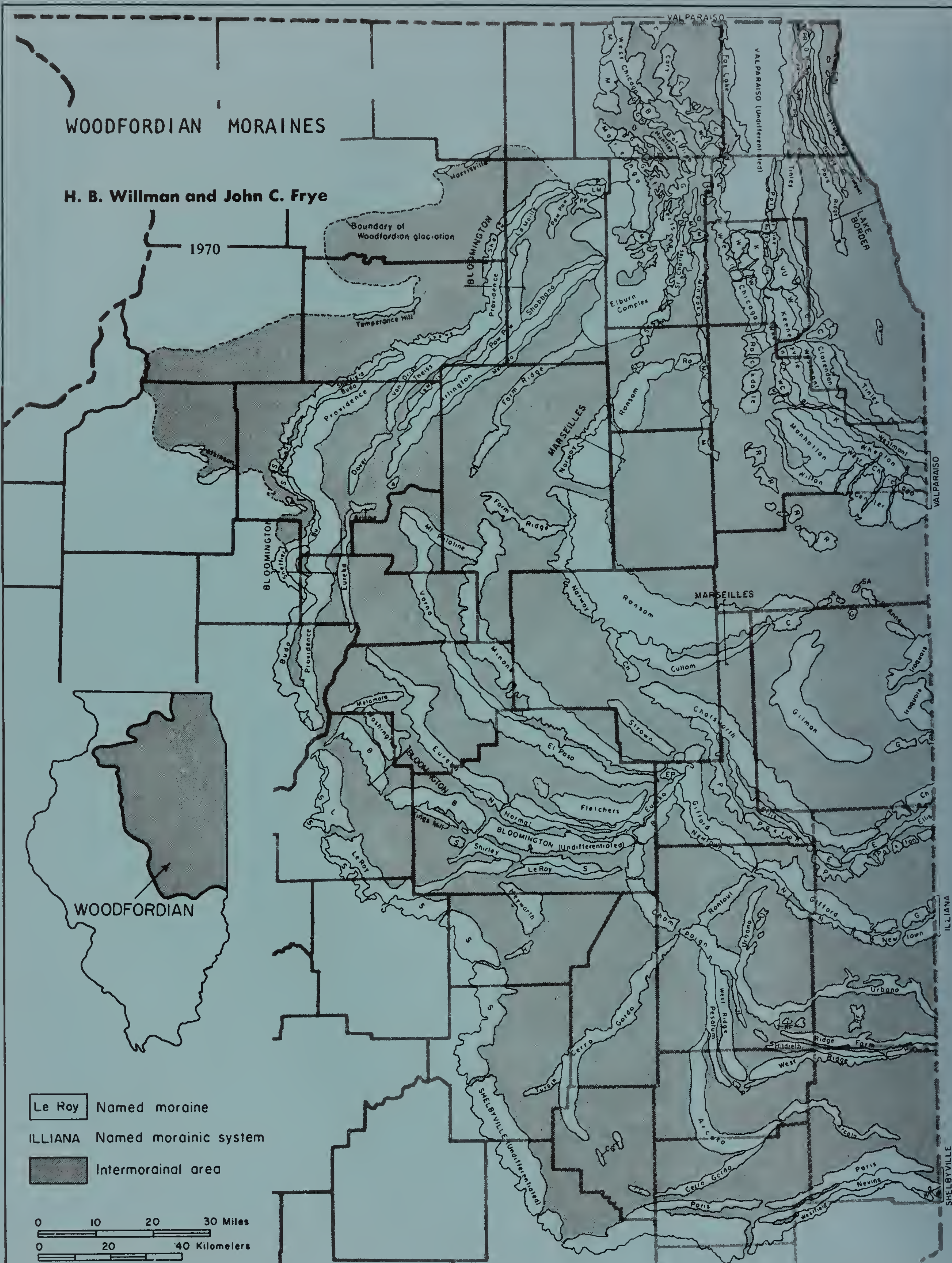
STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
HOLOCENE	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	7,000		
WISCONSINAN (4th glacial)	Valderan	Outwash, lake deposits	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation; building of many moraines as far south as Shelbyville; extensive valley trains, outwash plains, and lakes
	22,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers
	75,000		
SANGAMONIAN (3rd interglacial)		Soil, mature profile of weathering	
	175,000		
ILLINOIAN (3rd glacial)	Jubileean Monican Liman	Drift, loess Drift, loess Drift, loess	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	300,000		
YARMOUTHIAN (2nd interglacial)		Soil, mature profile of weathering	
	600,000		
KANSAN (2nd glacial)		Drift, loess	Glaciers from northeast and northwest covered much of state
	700,000		
AFTONIAN (1st interglacial)		Soil, mature profile of weathering	
	900,000		
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois
	1,200,000 or more		

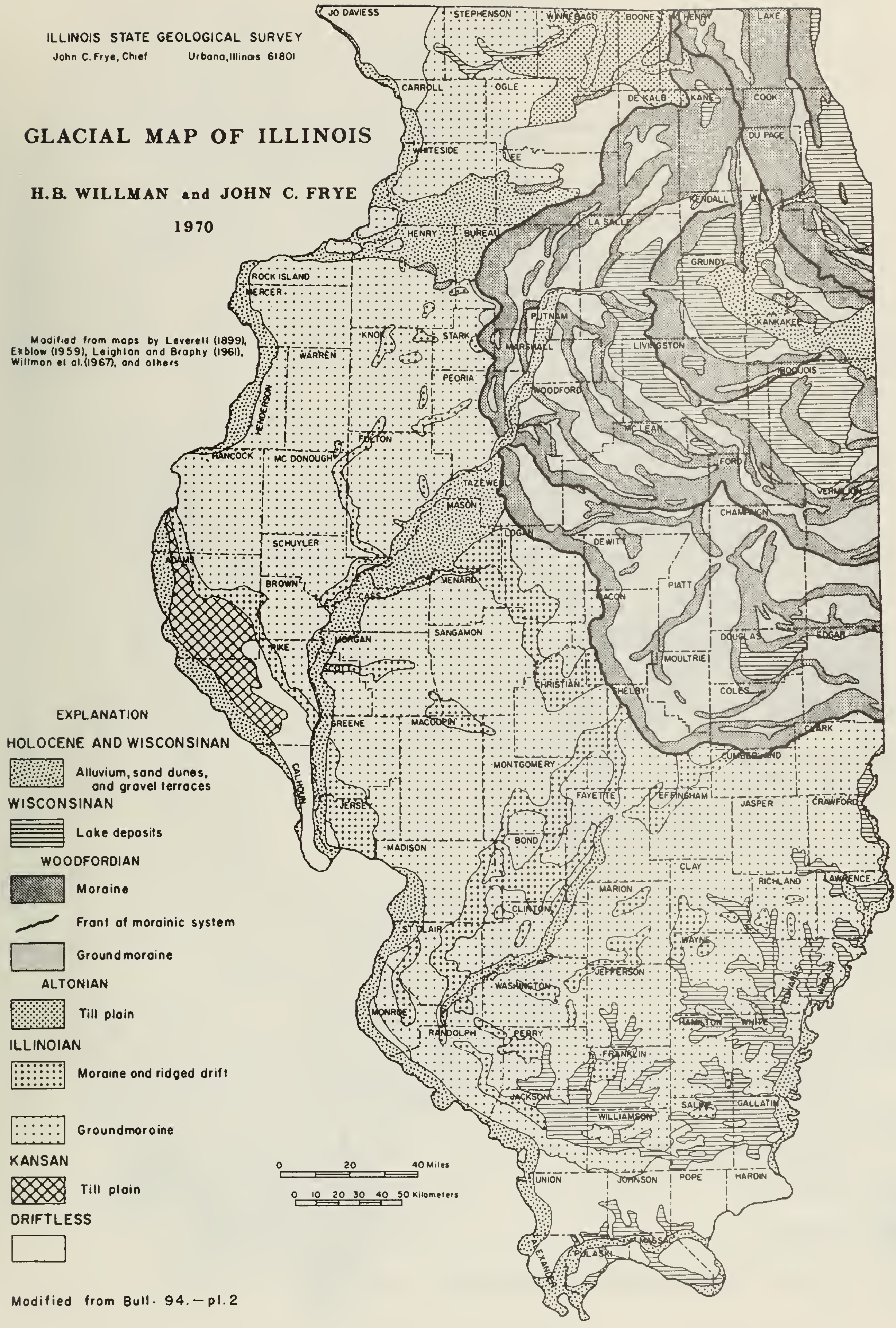
(Illinois State Geological Survey, 1973)

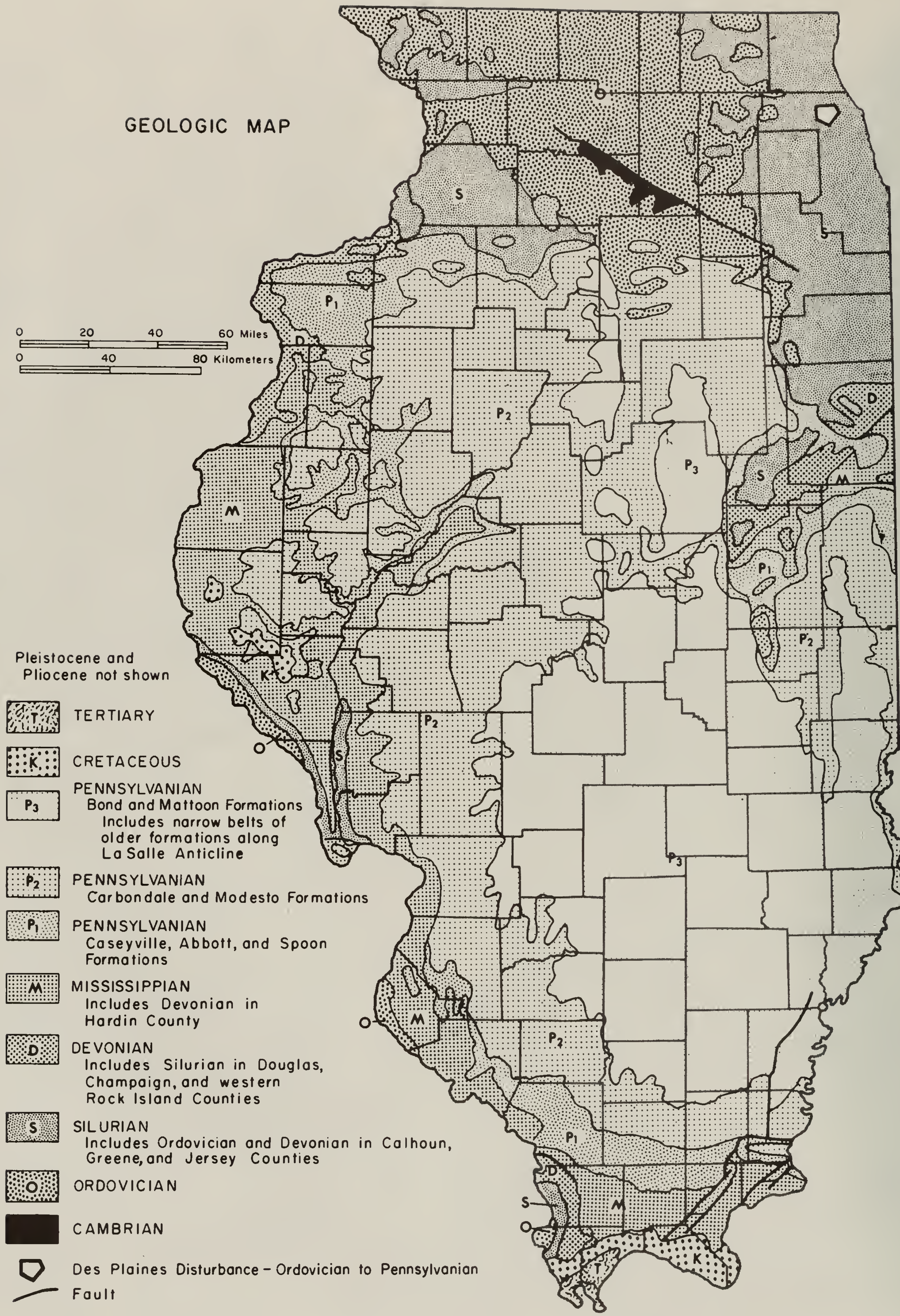
SEQUENCE OF GLACIATIONS AND INTERGLACIAL
DRAINAGE IN ILLINOIS



(From Willman and Frye, "Pleistocene Stratigraphy of Illinois," ISGS Bull. 94, fig. 5, 1970.)


WOODFORDIAN MORAINES
H. B. Willman and John C. Frye
1970
Boundary of Woodfordian glaciation
WOODFORDIAN
VALPARAISO
VALPARAISO (Undifferentiated)
West Chicago
Cary
Fox Lake
Tinley
Park Ridge
LAKE BORDER
Harrisville
BLOOMINGTON
Shabbona
Paw Paw
Providence
Temperance Hill
Elburn Complex
St. Charles
Minooka
Chicago
Keene
Rockdale
Clarendon
Tinley
Sheffield
Buda
Van Orin
Theiss
Arlington
Mendota
Farm Ridge
MARSEILLES
Ransom
Norway
Manhattan
Wheaton
Westmont
Wilton
Center
Dover
Atkinson
Mt. Palatine
Farm Ridge
Eureka
Varna
Minonk
Ransom
Cullom
Chatsworth
Iroquois
Gilman
Metamora
Washington
El Paso
Strawn
Fletchers
Normal
BLOOMINGTON (Undifferentiated)
Shirley
LeRoy
Gifford
Newtown
Paxton
Ellis
Heyworth
Rantoul
Urbana
Champaign
Gifford
Newtown
ILLIANA
Cerro Gordo
West Ridge
Pesotum
Hildreth
Ridge Farm
West Ridge
Urbana
Arcola
Arcola
Paris
Nevins
Westfield
Cerro Gordo
Paris
SHELBYVILLE (Undifferentiated)
SHELBYVILLE
Le Roy Named moraine
ILLIANA Named morainic system
Intermorainal area
0 10 20 30 Miles
0 20 40 Kilometers


ILLINOIS STATE GEOLOGICAL SURVEY
John C. Frye, Chief
Urbana, Illinois 61801
GLACIAL MAP OF ILLINOIS
H.B. WILLMAN and JOHN C. FRYE
1970
Modified from maps by Leverett (1899), Ekblow (1959), Leighton and Brophy (1961), Willman et al. (1967), and others
EXPLANATION
HOLOCENE AND WISCONSINAN
Alluvium, sand dunes, and gravel terraces
WISCONSINAN
Lake deposits
WOODFORDIAN
Moraine
Front of morainic system
Groundmoraine
ALTONIAN
Till plain
ILLINOIAN
Moraine and ridged drift
Groundmoraine
KANSAN
Till plain
DRIFTLESS
0 20 40 Miles
0 10 20 30 40 50 Kilometers
JO DAVIESS
STEPHENSON
WINNEBAGO
BOONE
McHENRY
LAKE
CARROLL
OGLE
DE KALB
KANE
COOK
DU PAGE
WHITESIDE
LEE
KENDALL
LA SALLE
HENRY
BUREAU
GRUNDY
ROCK ISLAND
MERCER
PUTNAM
KANKAKEE
KNOX
STARK
MARSHALL
LIVINGSTON
WARREN
PEORIA
IROQUOIS
HENDERSON
WOODFORD
McLEAN
FULTON
HANCOCK
Mc DONOUGH
FORD
TAZEWELL
VERMILION
MASON
CHAMPAIGN
LOGAN
DEWITT
SCHUYLER
ADAMS
BROWN
MENARD
PIATT
CASS
MACON
MORGAN
SANGAMON
DOUGLAS
EDGAR
PIKE
SCOTT
MOULTRIE
CHRISTIAN
SHELBY
COLES
GREENE
MACOUPIN
CLARK
CALHOUN
MONTGOMERY
CUMBERLAND
FAYETTE
EFFINGHAM
JERSEY
JASPER
CRAWFORD
MADISON
BOND
CLAY
RICHLAND
LAWRENCE
MARION
CLINTON
ST CLAIR
WAYNE
EDWARDS
WABASH
JEFFERSON
WASHINGTON
MONROE
HAMILTON
WHITE
RANDOLPH
PERRY
FRANKLIN
JACKSON
SALINE
GALLATIN
WILLIAMSON
UNION
JOHNSON
POPE
HARDIN
MASSAC
PULASKI
ALEXANDER
Modified from Bull. 94. — pl. 2


GEOLOGIC MAP
0 20 40 60 Miles
0 40 80 Kilometers
Pleistocene and Pliocene not shown
T TERTIARY
K CRETACEOUS
P3 PENNSYLVANIAN Bond and Mattoon Formations Includes narrow belts of older formations along La Salle Anticline
P2 PENNSYLVANIAN Carbondale and Modesto Formations
P1 PENNSYLVANIAN Caseyville, Abbott, and Spoon Formations
M MISSISSIPPIAN Includes Devonian in Hardin County
D DEVONIAN Includes Silurian in Douglas, Champaign, and western Rock Island Counties
S SILURIAN Includes Ordovician and Devonian in Calhoun, Greene, and Jersey Counties
O ORDOVICIAN
CAMBRIAN
Des Plaines Disturbance – Ordovician to Pennsylvanian
Fault
S
P1
D
P2
P3
S
M
M
D
P1
P2
K
S
P2
P3
M
P2
P1
D
S
M
T
K

ERA, ERATHEM	PERIOD, SYSTEM	EPOCH, SERIES	ORIGIN AND CHARACTER	GREATEST THICKNESS (ft)[1]	AGE (millions of years)[2]
CENOZOIC	QUATERNARY	PLEISTOCENE	Continental — glacial, river and stream, wind, lake, swamp, and colluvial deposits and soils	600	
			Major unconformity		1.5
	TERTIARY	PLIOCENE	Continental — river deposits, mostly gravel, some sand	50	
			Major unconformity		7
		EOCENE	Deltaic — mostly sand, some silt	300	
		PALEOCENE	Marine — mostly clay, some sand	150	
			Unconformity		64-65
MESOZOIC	CRETACEOUS	GULFIAN	Deltaic and nearshore marine — sand, some silt and clay, locally lignitic	500	125[3] 136[4] 225[5] 280[6]
			Major unconformity		
PALEOZOIC	PENNSYLVANIAN	VIRGILIAN MISSOURIAN DESMOINESIAN ATOKAN MORROWAN	Marine, deltaic, continental — cyclical deposits, mostly shale, sandstone, and siltstone with some limestone, coal, clay, black sheety shale; sandstone dominant in lower part, shale above; coal most prominent in middle part, limestone in upper part	3000	
			Major unconformity		315[7]
	MISSISSIPPIAN	CHESTERIAN	Marine, deltaic — cyclical deposits of limestone, sandstone, shale	1400	
		VALMEYERAN	Marine, deltaic — limestone, siltstone, shale, chert, sandstone	2000	
		KINDERHOOKIAN	Marine — shale, limestone, siltstone	150	345
	DEVONIAN	UPPER	Marine — shale, limestone	300	
			Unconformity		
		MIDDLE	Marine — largely limestone, some shale	450	
			Major unconformity		
		LOWER	Marine — cherty limestone, chert	1300	395
	SILURIAN	CAYUGAN	Marine — shale, siltstone, limestone	100	
		NIAGARAN	Marine — dolomite, limestone, shale, local reefs	1000	
		ALEXANDRIAN	Marine — dolomite, limestone, shale	150	
			Unconformity		430-440
	ORDOVICIAN	CINCINNATIAN	Marine — shale, limestone, siltstone, dolomite	300	
			Unconformity		
		CHAMPLAINIAN	Marine — limestone, dolomite, sandstone	1400	
			Major unconformity		
		CANADIAN	Marine — dolomite, sandstone	1000	500
	CAMBRIAN	CROIXAN	Marine — sandstone, dolomite, shale	4000	
			Major unconformity		525[8] 570[9]
PRECAMBRIAN			Intrusive igneous rocks — mostly granite		

[1] Greatest thickness in one locality.
[2] Radiometric age of beginning of interval. (After Harland [1964] and others. Estimates from chart by Van Eysinga [1972].)
[3] Beginning of Gulfian (est.).
[4] Beginning of Cretaceous.
[5] Beginning of Mesozoic.
[6] End of Pennsylvanian.
[7] Beginning of Pennsylvanian (est.).
[8] Beginning of Croixan (est.).
[9] Beginning of Cambrian.

Fig. 1—Summary of the age, origin, and thickness of Illinois rocks.

(from ISGS Bulletin 95).

SERIES	STAGE	SEQ.	MEG.	G-WEST	G-EAST	FORMATION	MEMBER
CHESTERIAN	ELVIRAN	Kaskaskia	Pope			Grove Church Sh.	
						Kinkaid Ls.	Goreville Ls. Cove Hill Sh. Negli Creek Ls.
						Degonia Ss.	
						Clore	Ford Station Ls. Tygett Ss. Cora Ls.
						Palestine Ss.	
						Menard Ls.	Allard Ls. Scottsburg Ls. Walche Ls.
						Waltersburg	
						Vienna Ls.	
						Tar Springs Ss.	
	HOM-BERGIAN			Okaw		Glen Dean Ls.	
						Hardinsburg Ss.	
					Gol-conda	Haney Ls.	
						Fraileys Sh.	Big Clifty Ss.
						Beech Creek Ls.	
	GASPERIAN				West Baden	Cypress Ss.	
				Paint Creek		Ridenhower	Reelsville Ls. Sample Ss. Beaver Bend Ls.
						Bethel Ss.	
			(WEST) / (EAST)		Cedar Bluff	Downeys Bluff Ls.	
						Yankeetown Ss.	
						Renault Ls.	Shetlerville Popcorn Ss. B. Levias Ls.
VALMEYERAN	GENEVIEVIAN					Aux Vases Ss.	Rosiclare Ss.
						Ste. Genevieve Ls.	Joppa Karnak Ls. Spar Mtn. Ss. Fredonia Ls.
			Mammoth Cave			St. Louis Ls.	
						Salem Ls.	Rocher Chalfin Fults Kidd
						Ullin Ls.	Harrodsburg Ls. Ramp Creek Ls.

NORTH and WEST		SOUTH and EAST	
FORMATION	MEMBER	FORMATION	FORMATION
Sonora		Fort Payne	
Warsaw Sh.			
Keokuk Ls.	Montrose Chert	Borden Sts. Bilyeu M.	Springville Sh. Stone Pond M.
Burlington Ls.			
Fern Glen			
Meppen Ls.			
Starrs Cave Ls.		Chouteau Ls.	
Prospect Hill Sts.			
McCraney Ls.			
Hannibal Sh.	Nutwood Sh.	Hannibal Sh.	
"Glen Park"			

Left columns of the lower part: SERIES — VALMEYERAN (to Meppen Ls.), KINDERHOOKIAN (Starrs Cave Ls. to "Glen Park"); SEQ. — Kaskaskia; MEG. — Mammoth Cave (WEST) / (EAST), Knobs (Hannibal Sh., "Glen Park"); G-WEST — North Hill (Starrs Cave Ls. to McCraney Ls.), New Albany; G-EAST — New Albany.

Seq. = Sequence MEG. = Megagroup G. = Group M. = Member B. = Bed

Fig. M-3—Classification of the Mississippian System.

(from ISGS Bulletin 95).

MISSISSIPPIAN DEPOSITION

(The following quotation is from Report of Investigations 216: Classification of Genevievian and Chesterian...Rocks of Illinois [1965] by D. H. Swann, pp. 11-16. One figure and short sections of the text are omitted.)

During the Mississippian Period, the Illinois Basin was a slowly subsiding region with a vague north-south structural axis. It was flanked by structurally neutral regions to the east and west, corresponding to the present Cincinnati and Ozark Arches. These neighboring elements contributed insignificant amounts of sediment to the basin. Instead, the basin was filled by locally precipitated carbonate and by mud and sand eroded from highland areas far to the northeast in the eastern part of the Canadian Shield and perhaps the northeastward extension of the Appalachians. This sediment was brought to the Illinois region by a major river system, which it will be convenient to call the Michigan River (fig. 4) because it crossed the present state of Michigan from north to south or northeast to southwest....

The Michigan River delivered much sediment to the Illinois region during early Mississippian time. However, an advance of the sea midway in the Mississippian Period prevented sand and mud from reaching the area during deposition of the St. Louis Limestone. Genevievian time began with the lowering of sea level and the alternating deposition of shallow-water carbonate and clastic units in a pattern that persisted throughout the rest of the Mississippian. About a fourth of the fill of the basin during the late Mississippian was carbonate, another fourth was sand, and the remainder was mud carried down by the Michigan River.

Thickness, facies, and crossbedding...indicate the existence of a regional slope to the southwest, perpendicular to the prevailing north 65° west trend of the shorelines. The Illinois Basin, although developing structurally during this time, was not an embayment of the interior sea. Indeed, the mouth of the Michigan River generally extended out into the sea as a bird-foot delta, and the shoreline across the basin area may have been convex more often than concave.

....The shoreline was not static. Its position oscillated through a range of perhaps 600 to 1000 or more miles. At times it was so far south that land conditions existed throughout the present area of the Illinois Basin. At other times it was so far north that there is no suggestion of near-shore environment in the sediments still preserved. This migration of the shoreline and of the accompanying sedimentation belts determined the composition and position of Genevievian and Chesterian rock bodies.

Lateral shifts in the course of the Michigan River also influenced the placement of the rock bodies. At times the river brought its load of sediment to the eastern edge of the basin, at times to the center, and at times to the western edge. This lateral shifting occurred within a range of about 200 miles. The Cincinnati and Ozark areas did not themselves provide sediments, but, rather, the Michigan River tended to avoid those relatively positive areas in favor of the down-warped basin axis.

Sedimentation belts during this time were not symmetrical with respect to the mouth of the Michigan River. They were distorted by the position of the river relative to the Ozark and Cincinnati shoal areas, but of greater importance was sea current or drift to the northwest. This carried off most of the mud contributed by the river, narrowing the shale belt east of the river mouth and broadening it west

of the mouth. Facies and isopach maps of individual units show several times as much shale west of the locus of sand deposition as east of it. The facies maps of the entire Chesterian...show maximum sandstone deposition in a northeast-southwest belt that bisects the basin. The total thickness of limestone is greatest along the southern border of the basin and is relatively constant along that entire border. The proportion of limestone, however, is much higher at the eastern end than along the rest of the southern border, because little mud was carried southeastward against the prevailing sea current. Instead, the mud was carried to the northwest and the highest proportion of shale is found in the northwestern part of the basin.

Genevievian and Chesterian seas generally extended from the Illinois Basin eastward across the Cincinnati Shoal area and the Appalachian Basin. Little terrigeneous sediment reached the Cincinnati Shoal area from either the west or the east, and the section consists of thin limestone units representing all or most of the major cycles. The proportion of inorganically precipitated limestone is relatively high and the waters over the shoal area were commonly hypersaline... Erosion of the shoal area at times is indicated by the presence of conodonts eroded from the St. Louis Limestone and redeposited in the lower part of the Gasper Limestone at the southeast corner of the Illinois Basin...

The shoal area included regions somewhat east of the present Cincinnati axis and extended from Ohio, and probably southeastern Indiana, through central and east-central Kentucky and Tennessee into Alabama....

Toward the west, the seaway was commonly continuous between the Illinois Basin and central Iowa, although only the record of Genevievian and earliest Chesterian is still preserved. The seas generally extended from the Illinois and Black Warrior regions into the Arkansas Valley region, and the presence of Chesterian outliers high in the Ozarks indicates that at times the Ozark area was covered. Although the sea was continuous into the Ouachita region, detailed correlation of the Illinois sediments with the geosynclinal deposits of this area is difficult.

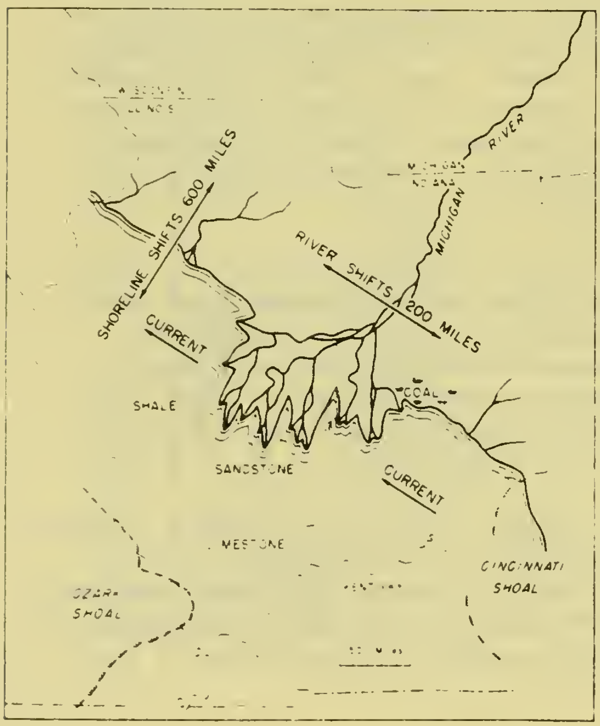
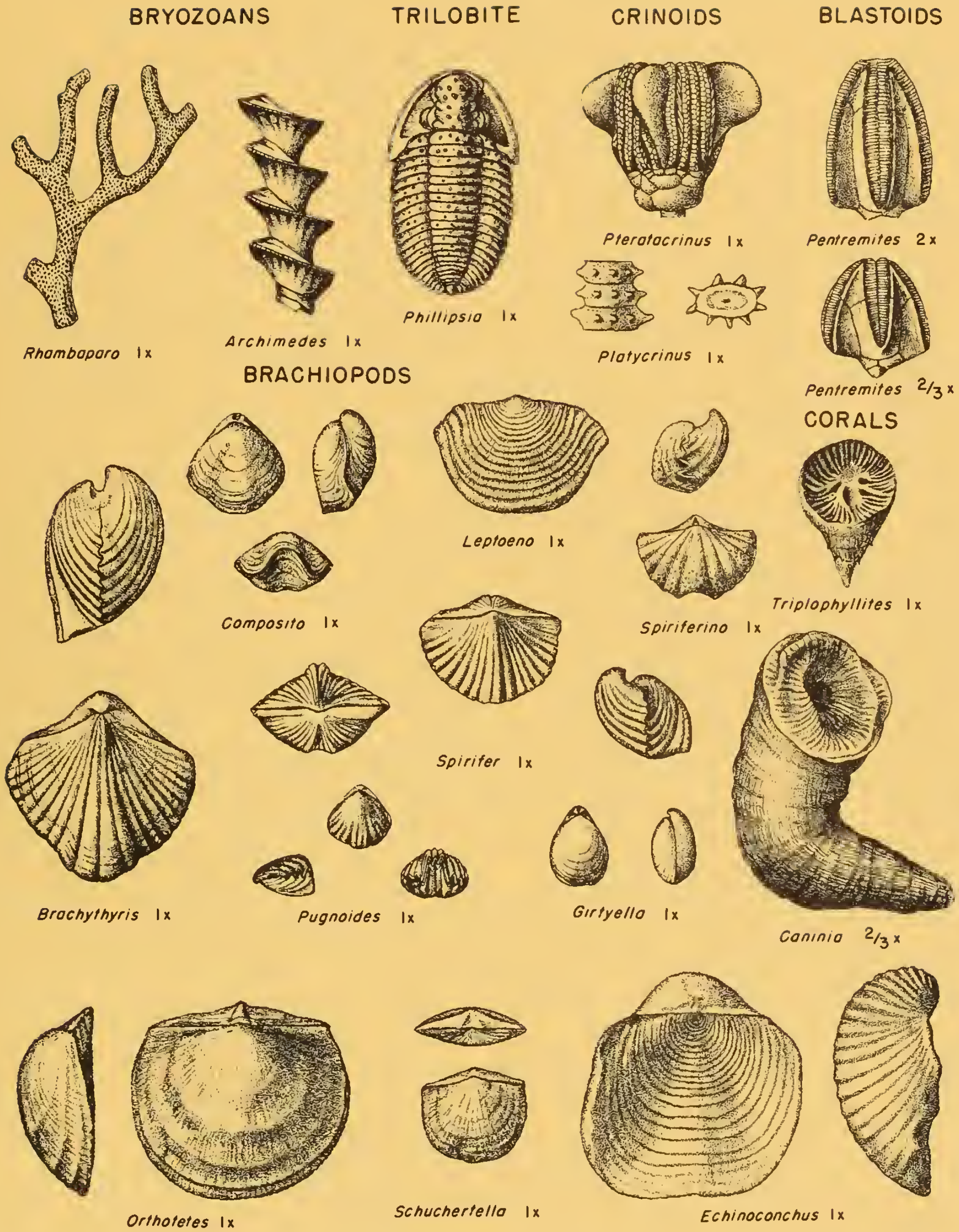


Figure 4: Paleogeography at an intermediate stage during Chesterian sedimentation.


BRYOZOANS
TRILOBITE
CRINOIDS
BLASTOIDS
Rhombopora 1x
Archimedes 1x
Phillipsia 1x
Pterotocrinus 1x
Platycrinus 1x
Pentremites 2x
Pentremites 2/3x
BRACHIOPODS
CORALS
Composita 1x
Leptaena 1x
Spiriferina 1x
Triplophyllites 1x
Spirifer 1x
Brachythyris 1x
Pugnoides 1x
Girtyella 1x
Caninia 2/3x
Orthotetes 1x
Schuchertella 1x
Echinoconchus 1x


SCALE
5 MILES
25 000 FEET
8 KILOMETERS
N
1 START
2
3
4
5
6 LUNCH
7
8
9
10
11 END
MISSISSIPPI
RIVER
NAV
LEE
COUNTY
T 8 N
91° 15′
91° 10′
40° 40′
R 8 W
PONTOOSUC
POP 226
LOMAX
POP 565
CARMAN
DURHAM
COLUSA
DISCO
NIOTA
ATCHISON
TOPEKA AND SANTA FE
FAP 685
FAP 522
FAP 514
FAP 510
DUTCHMAN IS
LEAD IS
CLIFFORD IS
TWO MILE IS
MILLMAN LAKE
CLEAR LAKE
S F BRIDGE (TOLL)
SPILLMAN
OPPOSUM
TYSON
WEAVER
HONEY
WILD CAT
SPRING
TILTON
CAMP
PEORIA DUGOUT
WESTERN
TOLEDO
PEORIA
A N O O S E
O N T O O S U C
D A L L A S
C I T Y
D U R H A M
L O M A X
C A R M A N
L A
H A
T E